UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

AMERICAN PATENTS, LLC	)	
	)	
Plaintiff.	)	Civil Action No. 6:21-cv-636
	)	
v.	)	JURY TRIAL DEMANDED
	)	
NEWELL BRANDS INC. and BRK BRANDS, INC.,	)	
	)	
Defendant.	)	

ANSWER AND COUNTERCLAIMS OF BRK BRANDS, INC. TO PLAINTIFF'S ORIGINAL COMPLAINT FOR PATENT INFRINGEMENT

Defendant BRK Brands, Inc., ("BRK") files this Answer and Counterclaims ("Answer") to Plaintiff American Patents LLC's ("American Patents" or "Plaintiff") Original Complaint for Patent Infringement ("Complaint"). The numbered paragraphs in this Answer and Counterclaims correspond to the like-numbered paragraphs of the Complaint, to the extent applicable. BRK denies the allegations and characterizations in the Complaint unless expressly admitted in the following paragraphs.

PARTIES

1. American Patents is a limited liability company formed under the laws of the State of Texas, with its principal place of business at 2325 Oak Alley, Tyler, Texas, 75703.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 1 of the Complaint and, on that basis, denies all such allegations.

2. Newell Brands Inc. is a corporation duly organized and existing under the laws of Delaware. Newell Brands Inc. may be served through its registered agent Corporation Service Company d/b/a CSC – Lawyers Incorporated at 211 E. 7th St., Ste. 620, Austin, Texas 78701.

ANSWER: BRK admits that Defendant Newell Brands Inc. is a corporation established under the laws of the State of Delaware.

3. BRK Brands, Inc. is a corporation duly organized and existing under the laws of Delaware. Newell Brands Inc. may be served through its registered agent Corporation Service Company d/b/a CSC – Lawyers Incorporated at 211 E. 7th St., Ste. 620, Austin, Texas 78701.

ANSWER: BRK admits that BRK Brands, Inc. is a corporation established under the laws of the State of Delaware. BRK does not contest personal service for the purpose of this action.

4. The Defendants identified in paragraphs 2-3 above (collectively, "Newell") lead and are part of an interrelated group of companies which together comprise one of the world's largest manufacturers of consumer and commercial products, including under the First Alert, BRK Electronics, and OneLink brands.

ANSWER: This paragraph contains legal conclusions for which no response is required. Nonetheless, BRK denies allegations in this paragraph of the Complaint.

5. The Newell defendants named above and their affiliates are part of the same corporate structure and distribution chain for the making, importing, offering to sell, selling, and using of the accused devices in the United States, including in the State of Texas generally and this judicial district in particular.

ANSWER: This paragraph contains legal conclusions for which no response is required. Nonetheless, BRK denies allegations in this paragraph of the Complaint.

6. The Newell defendants named above and their affiliates share the same management, common ownership, advertising platforms, facilities, distribution chains and platforms, and accused product lines and products involving related technologies.

ANSWER: This paragraph contains legal conclusions for which no response is required. Nonetheless, BRK denies allegations in this paragraph of the Complaint.

7. The Newell defendants named above and their affiliates regularly contract with customers regarding equipment or services that will be provided by their affiliates on their behalf.

ANSWER: This paragraph contains legal conclusions for which no response is

required. Nonetheless, BRK denies allegations in this paragraph of the Complaint.

8. Thus, the Newell defendants named above and their affiliates operate as a unitary business venture and are jointly and severally liable for the acts of patent infringement alleged herein.

ANSWER: This paragraph contains legal conclusions for which no response is required. Nonetheless, BRK denies allegations in this paragraph of the Complaint.

JURISDICTION AND VENUE

9. This is an action for infringement of United States patents arising under 35 U.S.C. §§ 271, 281, and 284–85, among others. This Court has subject matter jurisdiction of the action under 28 U.S.C. § 1331 and § 1338(a).

ANSWER: BRK admits, based solely on the allegations of the Complaint and without admitting them as true, that the Complaint purports to allege an action for patent infringement arising under 35 U.S.C. §§ 271, 281, and 284–85, among others, and that this Court has subject matter jurisdiction over such actions pursuant to 28 U.S.C. §§ 1331 and 1338(a). BRK denies all other allegations in this paragraph of the Complaint.

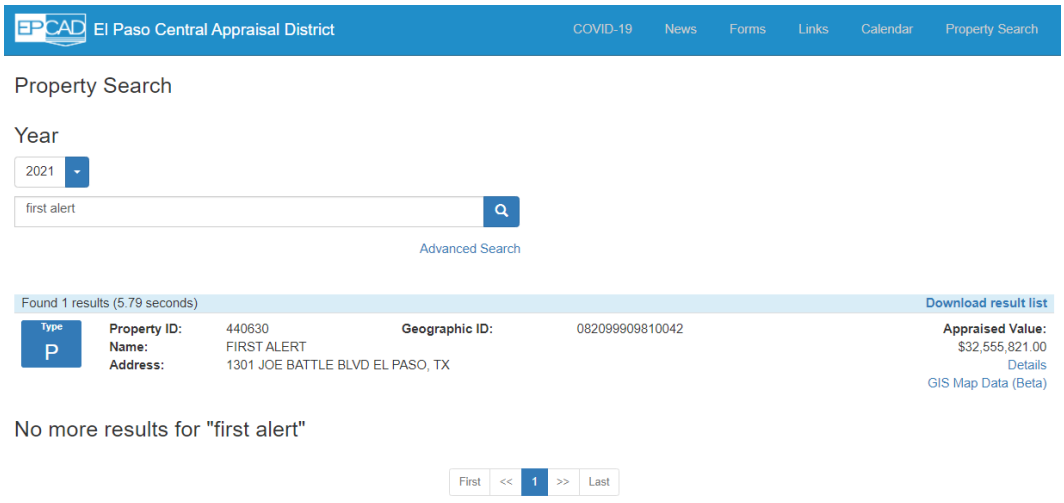
10. This Court has personal jurisdiction over Newell pursuant to due process and/or the Texas Long Arm Statute because, inter alia, (i) Newell has done and continues to do business in Texas; (ii) Newell has committed and continues to commit acts of patent infringement in the State of Texas, including making, using, offering to sell, and/or selling accused products in Texas, and/or importing accused products into Texas, including by Internet sales and sales via retail and wholesale stores, inducing others to commit acts of patent infringement in Texas, and/or committing a least a portion of any other infringements alleged herein; and (iii) Newell is registered to do business in Texas.

ANSWER: BRK does not contest whether personal jurisdiction over it properly lies in this District for purposes of this action, and denies any allegation, suggestion, or inference that personal jurisdiction is proper in this District for all actions. BRK admits that it has done, and continues to do business in Texas. BRK admits that it has the right to transact business in Texas. BRK denies all other allegations in this paragraph of the

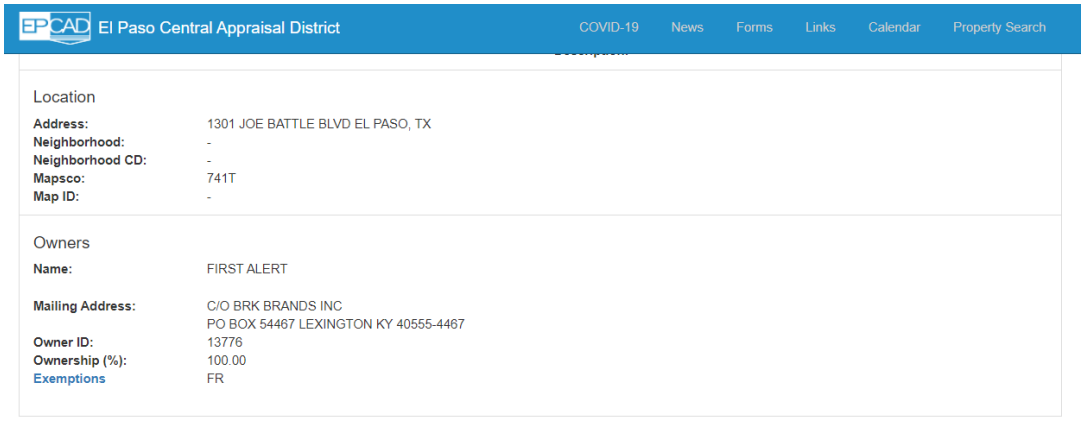
Complaint.

11. Venue is proper in this district pursuant to 28 U.S.C. § 1400(b). Venue is further proper because Newell has committed and continues to commit acts of patent infringement in this district, including making, using, offering to sell, and/or selling accused products in this district, and/or importing accused products into this district, including by Internet sales and sales via retail and wholesale stores, inducing others to commit acts of patent infringement in Texas, and/or committing at least a portion of any other infringements alleged herein in this district. Newell has regular and established places of business in this district, including at least at 1301 Joe Battle Blvd., El Paso, Texas 79936, as shown in the below screenshots:

(Source: screenshot from Google Maps Street View)



(Source: screenshot from El Paso County Appraisal District website)



(Source: screenshot from El Paso County Appraisal District website)

ANSWER: BRK does not contest the propriety of venue at this time and for this action only. BRK does not waive the right to contest the propriety of venue in another action. BRK does not admit that this venue is convenient and does not waive the right to seek transfer to a more convenient forum later in this or another action. BRK denies the remaining allegations in this paragraph of the Complaint.

BACKGROUND

12. The patents-in-suit generally pertain to communications networks and other technology used in "smart" devices such as smartphones, smart TVs, and smart appliances. The technology disclosed by the patents was developed by personnel at Georgia Institute of Technology ("Georgia Tech") and Nokia Corporation ("Nokia").

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

13. Georgia Tech is a leading public research university located in Atlanta, Georgia. Founded in 1885, Georgia Tech is often ranked as one of the top ten public universities in the United States. The patents from Georgia Tech ("the Mody patents") were developed by a professor and a graduate student in Georgia Tech's Electrical and Computer Engineering department. The undergraduate and graduate programs of this department are often ranked in the top five of their respective categories.

ANSWER: BRK admits that Georgia Tech is a public university located in Atlanta,

Georgia. BRK is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

14. The Mody patents are related to Multi-Input, Multi-Output (MIMO) technology. The inventors of the Mody patents were at the forefront of MIMO, developing, disclosing, and patenting a solution for achieving both time and frequency synchronization in MIMO systems. The Mody patents (or the applications leading to them) have been cited during patent prosecution hundreds of times, by numerous leading companies in the computing and communications industries, including AMD, Alcatel Lucent, Altair, AT&T, Atheros, Blackberry, Broadcom, Comcast, Ericsson, Facebook, HP, Hitachi, Huawei, Infineon, Intel, Interdigital, IBM, Kyocera, Marvell, Matsushita, Mediatek, Motorola, NEC, Nokia, Nortel Networks, NXP, Panasonic, Philips, Qualcomm, Realtek, Samsung, Sanyo, Sharp, Sony, STMicroelectronics, Texas Instruments, and Toshiba.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

15. Nokia is a Finnish multinational telecommunications, IT, and consumer electronics company. Listed on both the Helsinki Stock Exchange and the New York Stock Exchange, Nokia regularly makes the Fortune Global 500. Nokia has been the largest worldwide vendor of mobile phones and smartphones and has been a major contributor to the mobile phone industry.

ANSWER: BRK admits that Nokia is a company listed on various stock exchanges. BRK is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

16. The patent developed at Nokia ("the Rauhala patent") is related to reduction of interference in receivers with multiple antennas. The inventors of the Rauhala patent have a combined fifty plus years of experience at Nokia and were prolific inventors for Nokia. Inventor Jyri Rauhala spent over 25 years at Nokia. Mr. Rauhala obtained a Master of Science in Applied Electronics, Digital Electronics from Tampere University of Technology in Finland and is named as an inventor on 15 U.S. patents. Inventor Olli-Pekka Lunden spent over 8 years at Nokia. Dr. Lunden obtained a Doctor of Science in Technology, Radio Engineering from Aalto University and is named as an inventor on 5 U.S. patents. Currently, Dr. Lunden works as a university lecturer at Tampere University of Technology in Finland. Inventor Marko

Erkkila spent over twenty years at Nokia. Mr. Erkkila obtained a Master of Science in Digital Signal Processing, Electronics, Computer Science from Tampere University of Technology in Finland and is named as an inventor on 6 U.S. patents.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

COUNT I
[ALLEGED] DIRECT INFRINGEMENT OF U.S. PATENT NO. 7,088,782

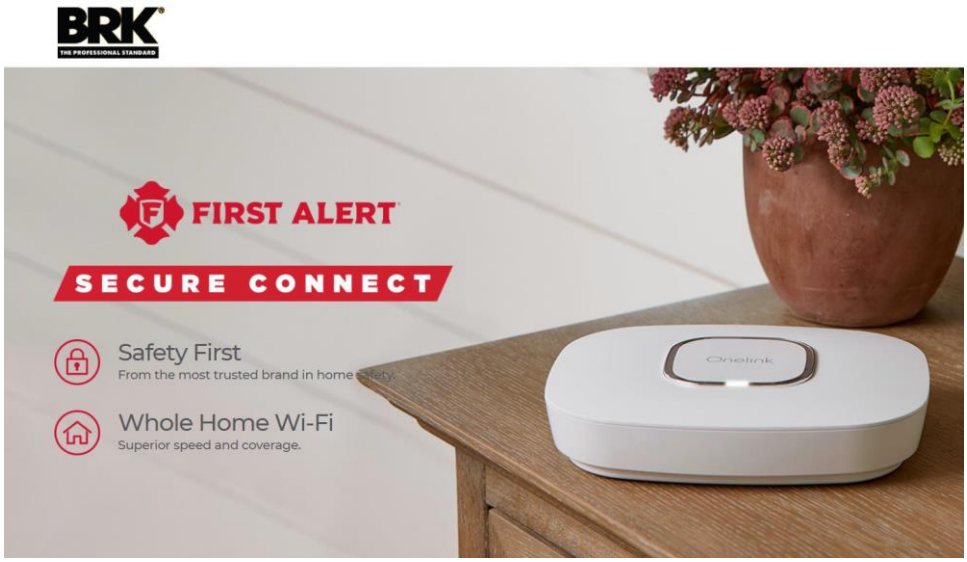
17. On August 8, 2006, United States Patent No. 7,088,782 ("the '782 Patent") was duly and legally issued by the United States Patent and Trademark Office for an invention entitled "Time And Frequency Synchronization In Multi-Input, Multi-Output (MIMO) Systems."

ANSWER: BRK admits that United States Patent No. 7,088,782 ("the '782 patent") is entitled "Time and Frequency Synchronization in Multi-Input, Multi-Output (MIMO) Systems" and shows as being issued by the U.S. Patent & Trademark Office ("USPTO") on August 8, 2006. BRK is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

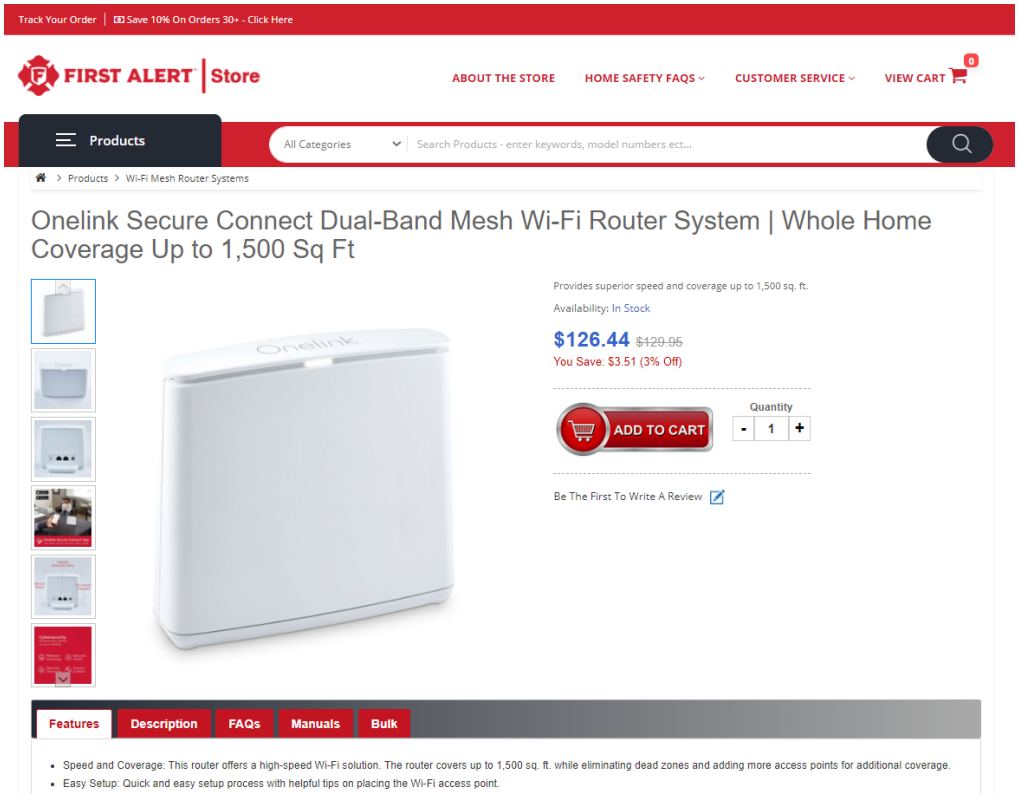
18. American Patents is the owner of the '782 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the '782 Patent against infringers, and to collect damages for all relevant times.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

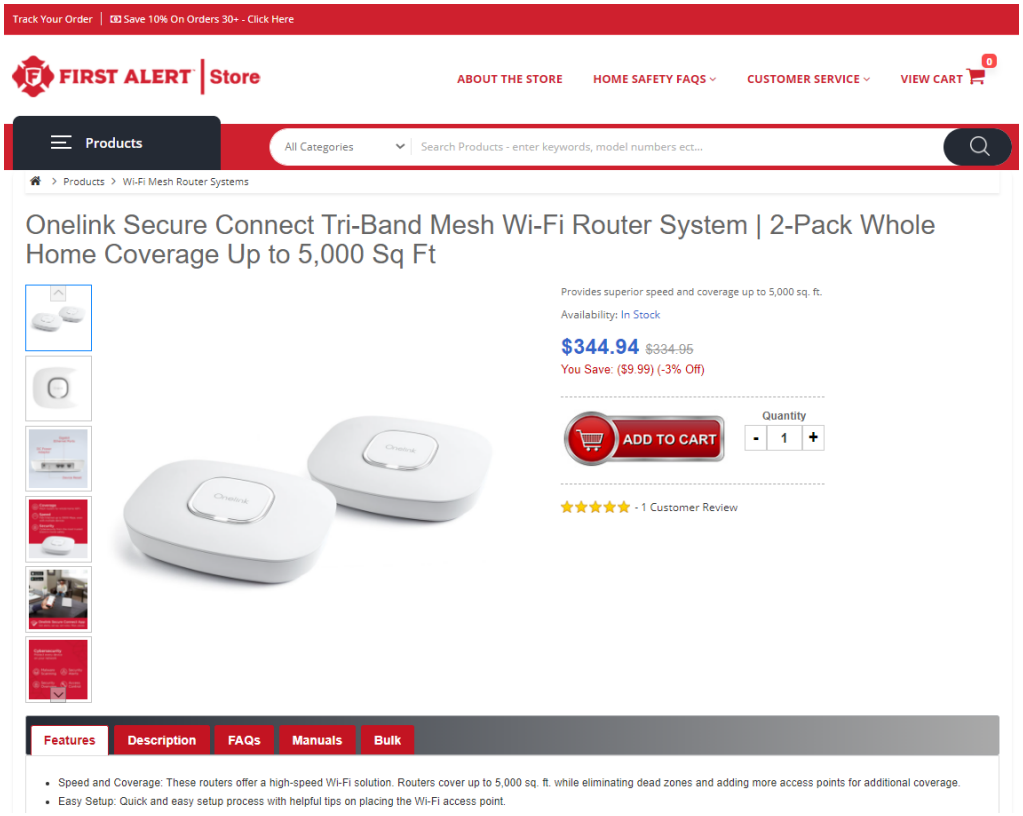
19. Newell used products and/or systems including, for example, its First Alert/Onelink Secure Connect AC1300 Home Wi-Fi Mesh Dual Band Solution and First Alert/Onelink Secure Connect AC3000 Home Wi-Fi Mesh Tri-Band Solution families of products that include 802.11n and above capabilities ("accused products"):



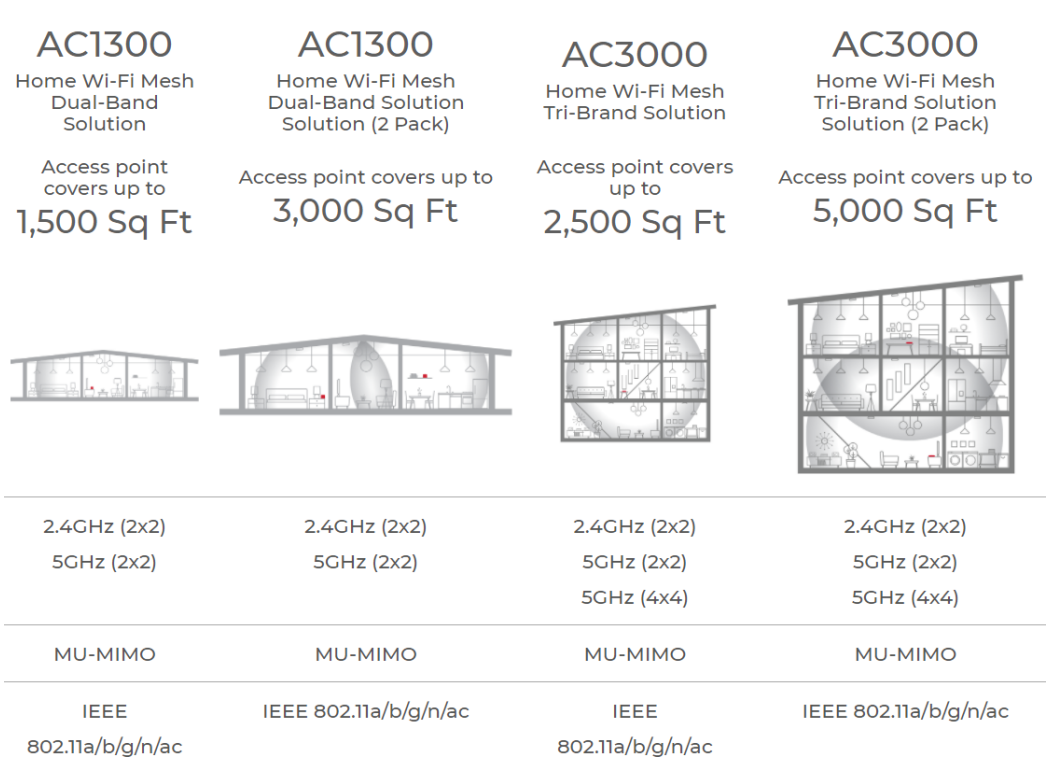
(Source : https://www.brkelectronics.com/secureconnect/)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-dual-band-mesh-wi-fi-router-system-1042081.htm)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-tri-band-mesh-wi-fi-router-system-2-pack-1042396.htm)



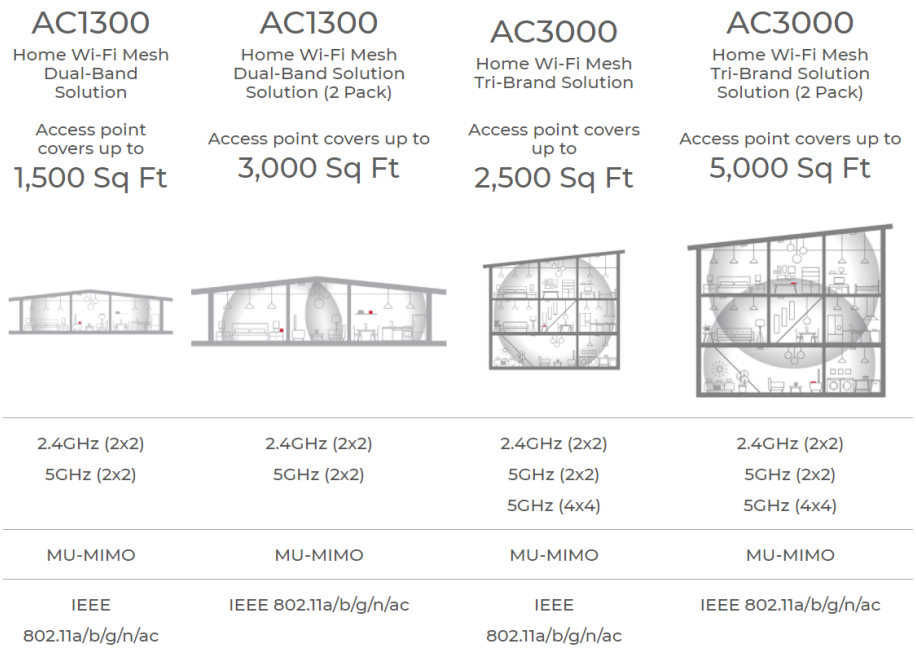
(Source : https://www.brkelectronics.com/secureconnect/)

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

20. By doing so, Newell has directly infringed (literally and/or under the doctrine of equivalents) at least Claim 30 of the '782 Patent. Newell's infringement in this regard is ongoing.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

21. Newell has infringed the '782 Patent by using the accused products and thereby practicing a method for synchronizing a Multi-Input Multi-Output (MIMO) Orthogonal Frequency Division Multiplexing (OFDM) system in time and frequency domains. For example, the accused products support IEEE 802.11 n/ac standards and MIMO technology. According to the IEEE 802.11n standard, the PLCP Protocol Data Unit (PPDU) has training fields and signaling fields for helping in synchronizing the communication system.



(Source : https://www.brkelectronics.com/secureconnect/)

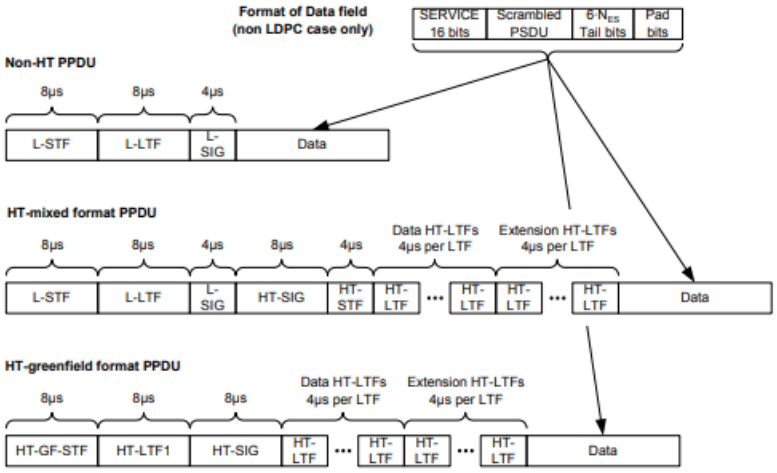


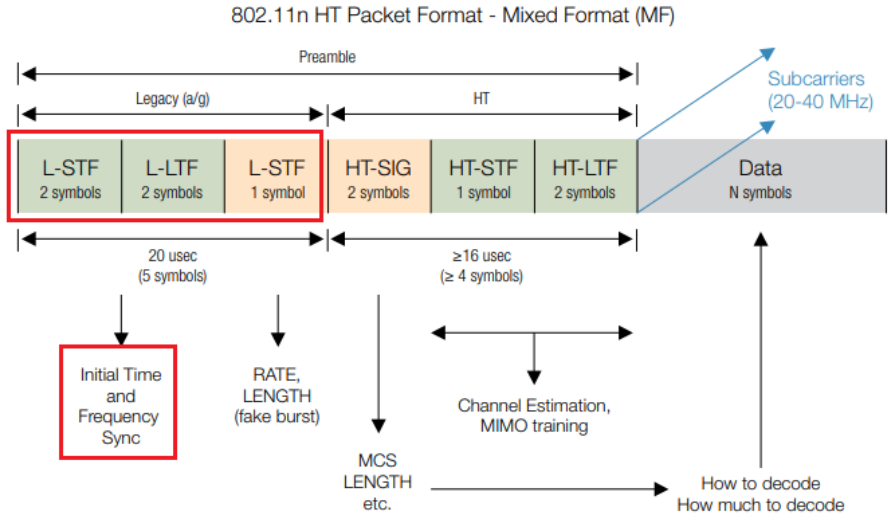
Figure 20-1—PPDU format

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

Table 20-4—Elements of the HT PLCP packet

Element	Description
L-STF	Non-HT Short Training field
L-LTF	Non-HT Long Training field
L-SIG	Non-HT SIGNAL field
HT-SIG	HT SIGNAL field
HT-STF	HT Short Training field
HT-GF-STF	HT-Greenfield Short Training field
HT-LTF1	First HT Long Training field (Data)
HT-LTFs	Additional HT Long Training fields (Data and Extension)
Data	The Data field includes the PSDU

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)



(Source: https://www.cnrood.com/en/media/solutions/Wi-Fi_Overview_of_the_802.11_Physical_Layer.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

22. The methods practiced by Newell's use of the accused products include producing a frame of data comprising a training symbol that includes a synchronization component that aids in synchronization, a plurality of data symbols, and a plurality of cyclic prefixes. For example, as part of the 802.11n standard, two preamble formats are defined for frames: HT-mixed format and HT-greenfield format. The non-HT and HT-mixed format preambles consist of training symbols, data symbols and guard intervals/cyclic prefixes, and the training symbols (L-STF and L-LTF fields) are and have been used for frame synchronization. Alternatively, on request from accused products, an 802.11 n/ac compliant WiFi access point can act as a transmitter and perform the step of producing a frame of data comprising a training symbol that includes a synchronization component that aids in synchronization, a plurality of data symbols, and a plurality of cyclic prefixes.

Two preamble formats are defined. For HT-mixed format operation, the preamble has a non-HT portion and an HT portion. The non-HT portion of the HT-mixed format preamble enables detection of the PPDU and acquisition of carrier frequency and timing by both HT STAs and STAs that are compliant with Clause 17 and/or Clause 19. The non-HT portion of the HT-mixed format preamble also consists of the SIGNAL field defined in Clause 17 and is thus decodable by STAs compliant with Clause 17 and Clause 19 as well as HT STAs.

The HT portion of the HT-mixed format preamble enables estimation of the MIMO channel to support demodulation of the HT data by HT STAs. The HT portion of the HT-mixed format preamble also includes the HT-SIG field, which supports HT operation. The SERVICE field is prepended to the PSDU.

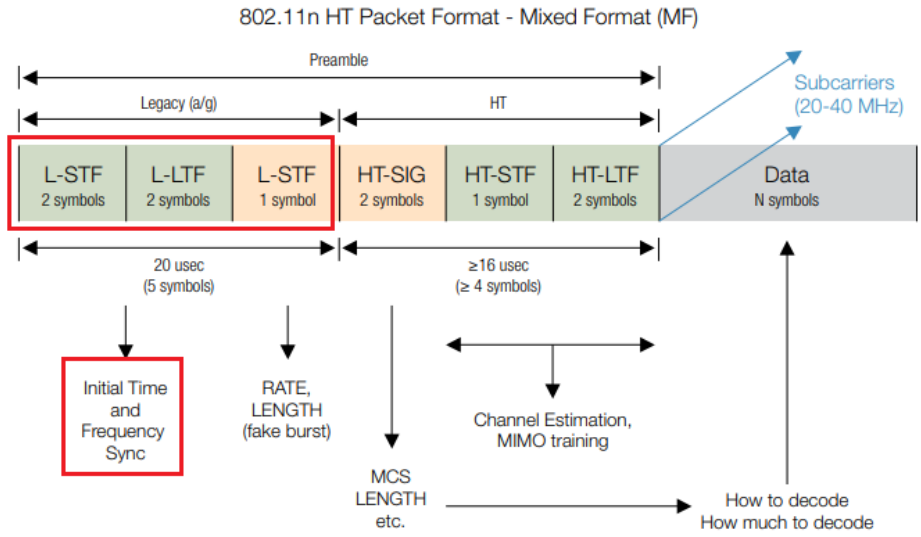
(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)



(Source: https://www.cnrood.com/en/media/solutions/Wi-Fi_Overview_of_the_802.11_Physical_Layer.pdf)

GI_TYPE	FORMAT is HT_MF or HT_GF	Indicates whether a short guard interval is used in the transmission of the packet. Enumerated type: LONG_GI indicates short GI is not used in the packet. SHORT_GI indicates short GI is used in the packet.	Y	Y
	Otherwise	Not present	N	N

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

23. The methods practiced by Newell's use of the accused products include transmitting the frame over a channel. The data frames containing the preambles are transmitted using one or more transmitting antennas. Alternatively, on request from an accused product, an 802.11 n/ac compliant WiFi access point can act as a transmitter and transmit the frame over a channel using one or more transmitting antennas.

20.3.9 HT preamble

20.3.9.1 Introduction

The HT preambles are defined in HT-mixed format and in HT-greenfield format to carry the required information to operate in a system with multiple transmit and multiple receive antennas.

In the HT-mixed format, to ensure compatibility with non-HT STAs, specific non-HT fields are defined so that they can be received by non-HT STAs compliant with Clause 17 or Clause 19 followed by the fields specific to HT STAs.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

20.3.10 Transmission of NON_HT format PPDUs with more than one antenna

When an HT device transmits a NON_HT format PPDU with the MODULATION parameter set to OFDM or ERP-OFDM using more than one transmit chain, it shall apply the cyclic shifts defined in Table 20-8 to the transmission in each chain.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

24. The methods practiced by Newell's use of the accused products include receiving the transmitted frame. For example, the receiving antennas of the accused products can receive the transmitted frames for further processing.

20.3.24 PLCP receive procedure

Typical PLCP receive procedures are shown in Figure 20-23 and Figure 20-24. The receive procedures correspond to HT-mixed format and HT-greenfield format, respectively. A typical state machine implementation of the receive PLCP is given in Figure 20-25. These receive procedures and state machine do not describe the operation of optional features, such as LDPC or STBC. If the detected format indicates a non-HT PPDU format, refer to the receive procedure and state machine in Clause 17 or Clause 19. Further, through station management (via the PLME), the PHY is set to the appropriate frequency, as specified in 20.4. Other receive parameters, such as RSSI and indicated DATARATE, may be accessed via the PHY-SAP.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

25. The methods practiced by Newell's use of the accused products include demodulating the received frame. For example, the received data frames are demodulated using the PLCP preambles.

20.3 HT PLCP sublayer

20.3.1 Introduction

A convergence procedure, in which PSDUs are converted to and from PPDUs, is provided for the HT PHY in 20.3. During transmission, the PSDU is processed (i.e., scrambled and coded) and appended to the PLCP preamble to create the PPDU. At the receiver, the PLCP preamble is processed to aid in demodulation and delivery of the PSDU.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

26. The methods practiced by Newell's use of the accused products include synchronizing the received demodulated frame to the transmitted frame such that the data symbols are synchronized in the time domain and frequency domain. For example, different fields of data like training symbols, cyclic prefixes and other signal bits are present in the received frame. The training symbols (L-STF and L-LTF fields) help in synchronizing the frame in both the time domain and frequency domain.

AC1300	AC1300	AC3000	AC3000
Home Wi-Fi Mesh Dual-Band Solution	Home Wi-Fi Mesh Dual-Band Solution Solution (2 Pack)	Home Wi-Fi Mesh Tri-Brand Solution	Home Wi-Fi Mesh Tri-Brand Solution Solution (2 Pack)
Access point covers up to 1,500 Sq Ft	Access point covers up to 3,000 Sq Ft	Access point covers up to 2,500 Sq Ft	Access point covers up to 5,000 Sq Ft
2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)
MU-MIMO	MU-MIMO	MU-MIMO	MU-MIMO
IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac

(Source : https://www.brkelectronics.com/secureconnect/)

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

a) Detect the start of frame.
b) Detect the transition from short sequences to channel estimation sequences, and establish fine timing (with one sample resolution).
c) Estimate the coarse and fine frequency offsets.
d) Derotate the frame according to estimated frequency offset.
e) Estimate the complex channel response coefficients for each of the subcarriers and each of the transmit chains.
f) For each of the data OFDM symbols, transform the symbol into subcarrier received values, estimate the phase from the pilot subcarriers in all spatial streams, derotate the subcarrier values according to estimated phase, group the results from all the receiver chains in each subcarrier to a vector, multiply the vector by a zero-forcing equalization matrix generated from the channel estimated during the channel estimation phase.
g) For each data-carrying subcarrier in each spatial stream, find the closest constellation point and compute the Euclidean distance from it.
h) Compute the average of the RMS of all errors in a frame. It is given by Equation (20-89).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

17.3.2.1 Overview of the PPDU encoding process

The encoding process is composed of many detailed steps, which are described fully in later subclauses, as noted below. The following overview intends to facilitate understanding the details of the convergence procedure:

a) Produce the PLCP Preamble field, composed of 10 repetitions of a "short training sequence" (used for AGC convergence, diversity selection, timing acquisition, and coarse frequency acquisition in the receiver) and two repetitions of a "long training sequence" (used for channel estimation and fine frequency acquisition in the receiver), preceded by a guard interval (GI). Refer to 17.3.3 for details.

(Source: https://www.iith.ac.in/~tbr/teaching/docs/802.11-2007.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

27. The methods practiced by Newell's use of the accused products include wherein the synchronizing in the time domain comprises coarse time synchronizing and fine time synchronizing. For example, the demodulation of PPDU frames also includes detecting training field bits and establishing a timing synchronization. This time synchronization would include both coarse and fine time synchronization. In general, coarse time synchronization is done using L-STF field and fine time synchronization is done using L-LTF field present in the preamble.

a) Detect the start of frame.
b) Detect the transition from short sequences to channel estimation sequences, and establish fine timing (with one sample resolution).
c) Estimate the coarse and fine frequency offsets.
d) Derotate the frame according to estimated frequency offset.
e) Estimate the complex channel response coefficients for each of the subcarriers and each of the transmit chains.
f) For each of the data OFDM symbols, transform the symbol into subcarrier received values, estimate the phase from the pilot subcarriers in all spatial streams, derotate the subcarrier values according to estimated phase, group the results from all the receiver chains in each subcarrier to a vector, multiply the vector by a zero-forcing equalization matrix generated from the channel estimated during the channel estimation phase.
g) For each data-carrying subcarrier in each spatial stream, find the closest constellation point and compute the Euclidean distance from it.
h) Compute the average of the RMS of all errors in a frame. It is given by Equation (20-89).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The simplest packet is the one used when operating in the legacy mode, which has the same format as the packets used in 802.11a/g. The L-STF field, which stands for the *legacy-short training field*, consists of two augmented OFDM symbols of 4 μs duration each, and these are used by the receiver to perform time and frequency synchronization and to adjust its AGC. After the two L-STF augmented OFDM symbols, there is a second field called L-LTF, which stands for *legacy-long training field*, which is used to perform fine timing adjustments after the initial coarse acquisition in the L-STF field. The third field, called L-SIG, which stands for *legacy signal field*, contains data that tell the receiver what modulation and coding will be used in the data portion of the packet. The L-SIG field consists of one augmented OFDM symbol.

(Source: Introduction to MIMO Communications, Hampton, Jerry R. (2014))

Receive procedure

Typically, the receiver waits for a signal to exceed a threshold before initiating the packet reception procedure. The minimum requirement in 802.11a is to detect the start of a valid transmission received at a power level of at least −82 dBm within 4 μs with a probability greater than 90%. Due to competitive pressures, most products exceed this specification by 5–10 dB.

The short training symbols are processed to set the AGC, initial frequency correction, and initial timing acquisition. This is followed by processing the long training symbols for fine frequency correction and fine timing adjustment. The LTF is also used to generate the channel estimate.

(Source: Next Generation Wireless LANs: 802.11n and 802.11ac, Perahia, Eldad and Stacey, Robert)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

28. Newell has had actual knowledge of the '782 Patent at least as of the date when it was notified of the filing of this action. By the time of trial, Newell will have known and intended (since receiving such notice) that its continued actions would infringe and actively induce and contribute to the infringement of one or more claims of the '782 Patent.

ANSWER: BRK admits that it has had knowledge of the '782 Patent as of the date that

BRK was served with a copy of Plaintiff's Complaint. BRK denies the remaining allegations of this paragraph of the complaint.

29. Newell has also indirectly and willfully infringed, and continues to indirectly and willfully infringe, the '782 Patent, as explained further below in the "Additional Allegations Regarding Infringement" section.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

30. American Patents has been damaged as a result of the infringing conduct by Newell alleged above. Thus, Newell is liable to American Patents in an amount that adequately compensates it for such infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

31. American Patents and/or its predecessors-in-interest have satisfied all statutory obligations required to collect pre-filing damages for the full period allowed by law for infringement of the '782 Patent.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

COUNT II
[ALLEGED] DIRECT INFRINGEMENT OF U.S. PATENT NO. 7,310,304

32. On December 18, 2007, United States Patent No. 7,310,304 ("the '304 Patent") was duly and legally issued by the United States Patent and Trademark Office for an invention entitled "Estimating Channel Parameters in Multi-Input, Multi-Output (MIMO) Systems."

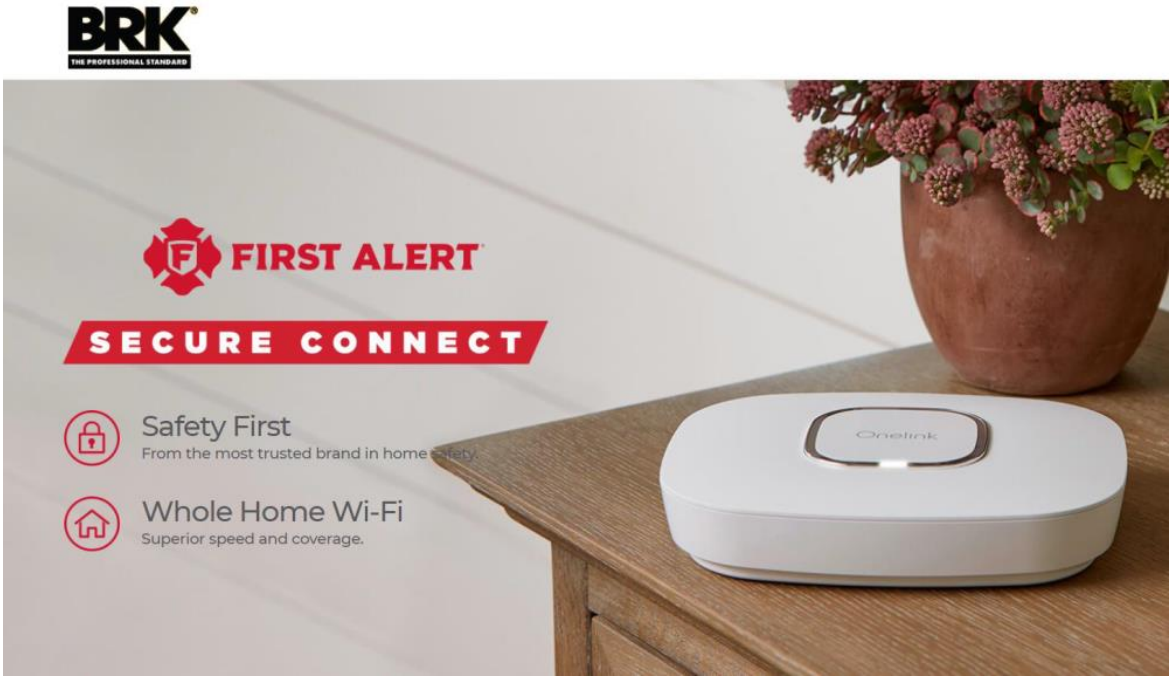
ANSWER: BRK admits that United States Patent No. 7,310,304 ("the '304 patent") is entitled "Estimating Channel Parameters in Multi-Input, Multi-Output (MIMO) Systems" and shows as being issued by the USPTO on December 18, 2007. BRK is without knowledge or information sufficient to form a belief as to the truth of the remaining

allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

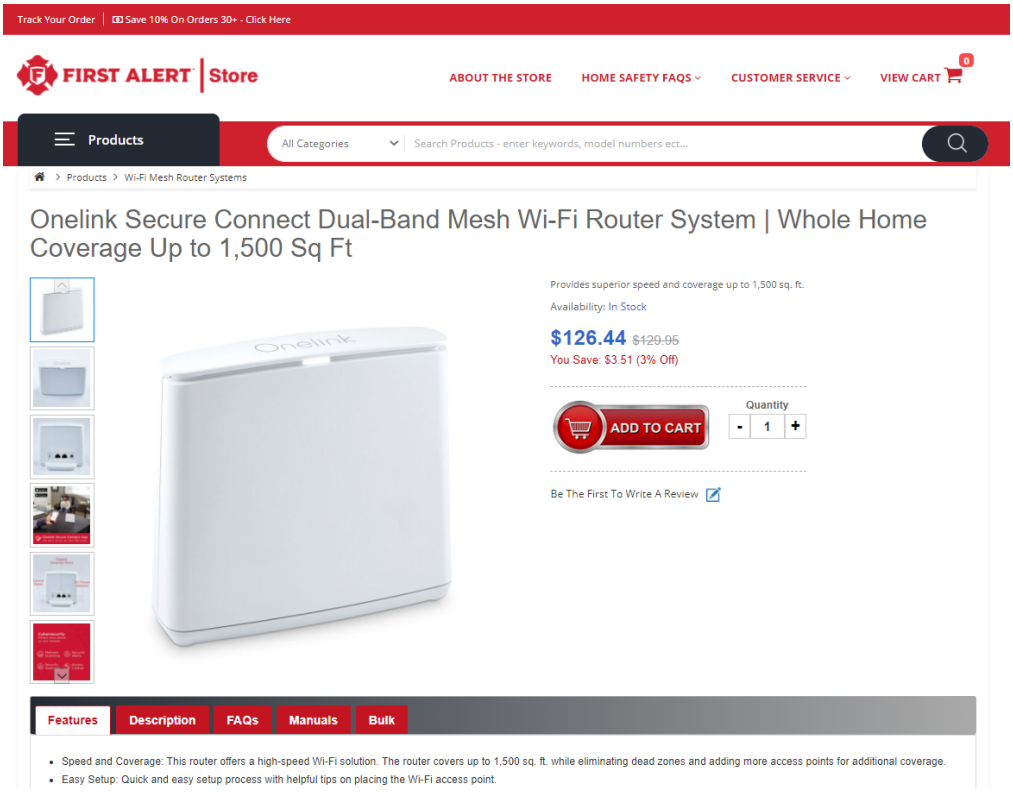
33. American Patents is the owner of the '304 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the '304 Patent against infringers, and to collect damages for all relevant times.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

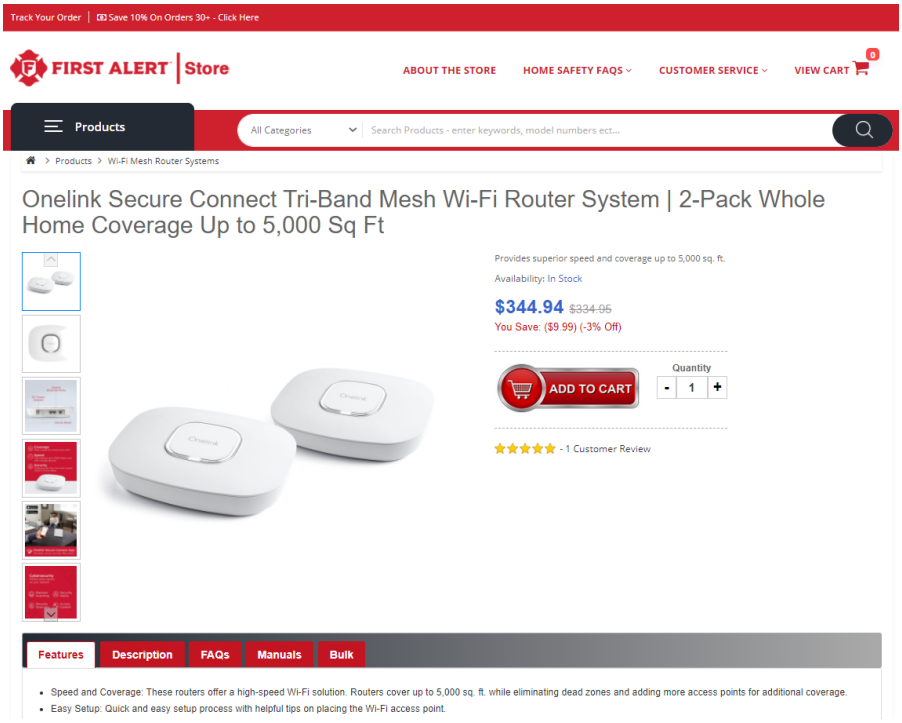
34. Newell made, had made, used, imported, provided, supplied, distributed, sold, and/or offered for sale products and/or systems including, for example, its First Alert/Onelink Secure Connect AC1300 Home Wi-Fi Mesh Dual Band Solution and First Alert/Onelink Secure Connect AC3000 Home Wi-Fi Mesh Tri-Band Solution families of products that include 802.11n and above capabilities ("accused products"):



(Source : https://www.brkelectronics.com/secureconnect/)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-dual-band-mesh-wi-fi-router-system-1042081.htm)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-tri-band-mesh-wi-fi-router-system-2-pack-1042396.htm)

AC1300	AC1300	AC3000	AC3000
Home Wi-Fi Mesh Dual-Band Solution	Home Wi-Fi Mesh Dual-Band Solution Solution (2 Pack)	Home Wi-Fi Mesh Tri-Brand Solution	Home Wi-Fi Mesh Tri-Brand Solution Solution (2 Pack)
Access point covers up to 1,500 Sq Ft	Access point covers up to 3,000 Sq Ft	Access point covers up to 2,500 Sq Ft	Access point covers up to 5,000 Sq Ft
2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)
MU-MIMO	MU-MIMO	MU-MIMO	MU-MIMO
IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac

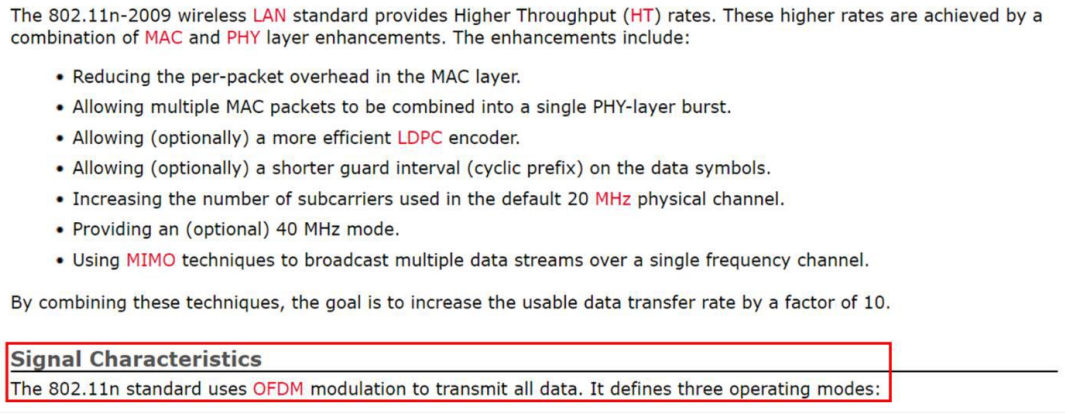
(Source : https://www.brkelectronics.com/secureconnect/)

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

35. By doing so, Newell has directly infringed (literally and/or under the doctrine of equivalents) at least Claim 1 of the '304 Patent. Newell's infringement in this regard is ongoing.

ANSWER: BRK denies the allegations in this paragraph of the complaint.

36. Newell has infringed the '304 Patent by making, having made, using, importing, providing, supplying, distributing, selling or offering for sale products including an Orthogonal Frequency Division Multiplexing (OFDM) transmitter. For example, the accused products support IEEE 802.11 n/ac standards and MIMO technology. The IEEE 802.11n standard "uses OFDM modulation to transmit all data."



The 802.11n-2009 wireless LAN standard provides Higher Throughput (HT) rates. These higher rates are achieved by a combination of MAC and PHY layer enhancements. The enhancements include:

- Reducing the per-packet overhead in the MAC layer.
- Allowing multiple MAC packets to be combined into a single PHY-layer burst.
- Allowing (optionally) a more efficient LDPC encoder.
- Allowing (optionally) a shorter guard interval (cyclic prefix) on the data symbols.
- Increasing the number of subcarriers used in the default 20 MHz physical channel.
- Providing an (optional) 40 MHz mode.
- Using MIMO techniques to broadcast multiple data streams over a single frequency channel.

By combining these techniques, the goal is to increase the usable data transfer rate by a factor of 10.

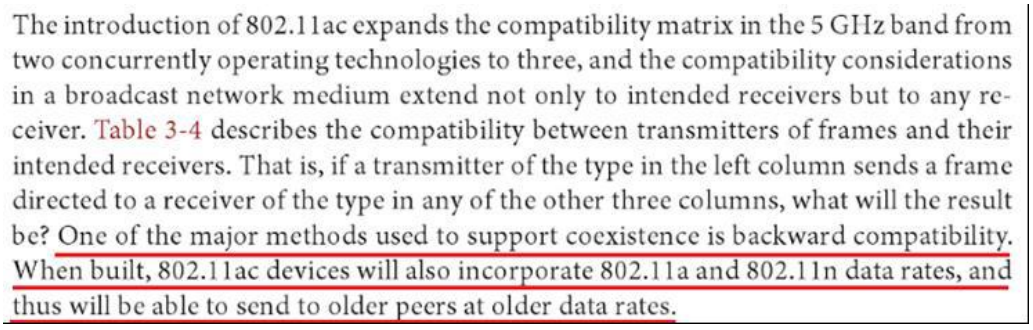
Signal Characteristics

The 802.11n standard uses OFDM modulation to transmit all data. It defines three operating modes:

(Source: http://rfmw.em.keysight.com/wireless/helpfiles/89600b/webhelp/subsystems/wlan-mimo/Content/mimo_80211n_overview.htm)

ANSWER: The allegations of the paragraph are too vague to be understood, and BRK therefore lacks knowledge or information to form a belief about the truth of the remaining allegations in this paragraph of the Complaint and therefore denies the same.

37. The accused products include an encoder configured to process data to be transmitted within an OFDM system, the encoder further configured to separate the data onto one or more transmit diversity branches (TDBs). For example, the 802.11 ac standard is backwards compatible with 802.11n and 802.11a. Thus, if a device, such as an accused product, implements 802.11ac, then it also supports 802.11n and all previous versions of the WiFi standards (i.e., IEEE 802.11 a/b/g/n). According to the IEEE 802.11n standard, an encoder block is present in a transmitter section of general OFDM systems. The encoder(s) output(s) the data onto multiple transmit chains (transmit diversity branches) for further processing.



The introduction of 802.11ac expands the compatibility matrix in the 5 GHz band from two concurrently operating technologies to three, and the compatibility considerations in a broadcast network medium extend not only to intended receivers but to any receiver. Table 3-4 describes the compatibility between transmitters of frames and their intended receivers. That is, if a transmitter of the type in the left column sends a frame directed to a receiver of the type in any of the other three columns, what will the result be? One of the major methods used to support coexistence is backward compatibility. When built, 802.11ac devices will also incorporate 802.11a and 802.11n data rates, and thus will be able to send to older peers at older data rates.

(Source: 802.11ac: A Survival Guide: Wi-Fi at Gigabit and Beyond, Gast, Matthew S.)

Table 3-5. Compatibility between transmitters and listening devices

Transmitter type	802.11a listener	802.11n listener	802.11ac listener
802.11a	Designed operation	802.11n devices listen to 802.11a frames and defer medium access to avoid collisions	802.11ac devices listen to 802.11a frames and defer medium access to avoid collisions
802.11n	802.11n greenfield frames require RTS/CTS or CTS-to-self protection; 802.11n mixed-mode frames require no special protection	Designed operation	802.11ac devices listen to 802.11n frames and defer medium access to avoid collisions
802.11ac	802.11ac uses a compatible physical preamble, allowing 802.11a devices to read the medium as busy and avoid collisions	802.11ac uses a compatible preamble, allowing 802.11n devices to read the medium as busy and avoid collisions	Designed operation

(Source: 802.11ac: A Survival Guide: Wi-Fi at Gigabit and Beyond, Gast, Matthew S.)

20.3.3 Transmitter block diagram

HT-mixed format and HT-greenfield format transmissions can be generated using a transmitter consisting of of the following blocks:

a) *Scrambler* scrambles the data to reduce the probability of long sequences of zeros or ones; see 20.3.11.2.

b) *Encoder parser*, if BCC encoding is to be used, demultiplexes the scrambled bits among N_{ES} (number of BCC encoders for the Data field) BCC encoders, in a round robin manner.

c) *FEC encoders* encode the data to enable error correction. An FEC encoder may include a binary convolutional encoder followed by a puncturing device, or it may include an LDPC encoder.

d) *Stream parser* divides the outputs of the encoders into blocks that are sent to different interleaver and mapping devices. The sequence of the bits sent to an interleaver is called a *spatial stream*.

e) *Interleaver* interleaves the bits of each spatial stream (changes order of bits) to prevent long sequences of adjacent noisy bits from entering the BCC decoder. Interleaving is applied only when BCC encoding is used.

f) *Constellation mapper* maps the sequence of bits in each spatial stream to constellation points (complex numbers).

g) *STBC* encoder spreads constellation points from N_{SS} spatial streams into N_{STS} space-time streams using a space-time block code. STBC is used only when $N_{SS} < N_{STS}$; see 20.3.11.8.1.

h) *Spatial mapper* maps space-time streams to transmit chains. This may include one of the following:

   1) *Direct mapping*: Constellation points from each space-time stream are mapped directly onto the transmit chains (one-to-one mapping).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

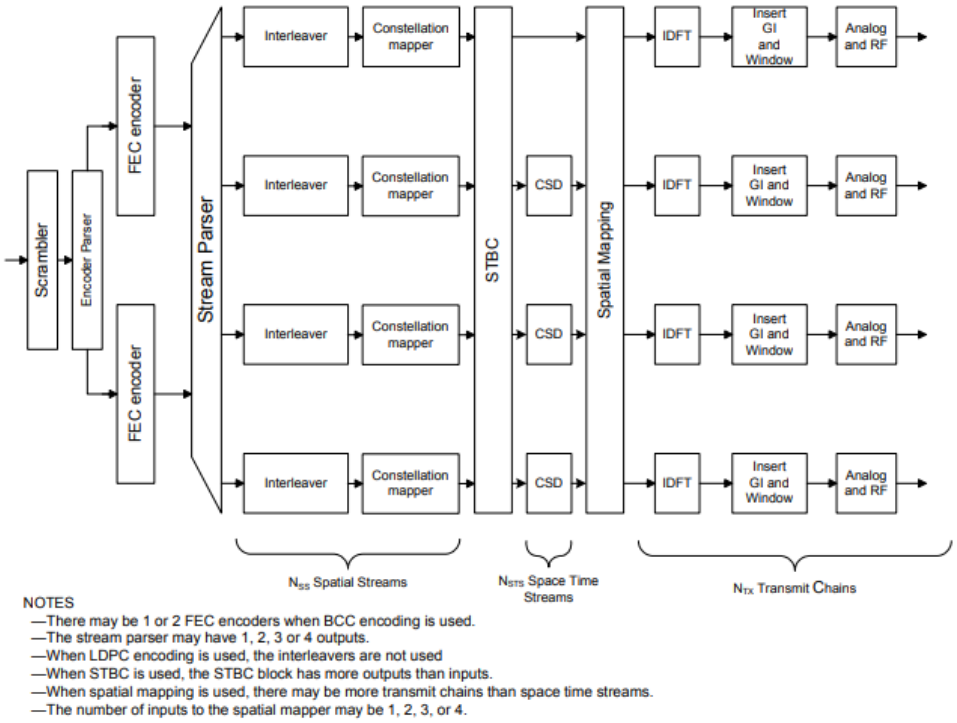


Figure 20-3—Transmitter block diagram 2

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

38. The accused products include one or more OFDM modulators, each OFDM modulator connected to a respective TDB, each OFDM modulator configured to produce a frame including a plurality of data symbols, a training structure, and cyclic prefixes inserted among the data symbols. For example, according to the IEEE 802.11n standard, a transmitter block would contain different functional blocks which include constellation mappers, IDFT stage, and Guard interval insertion. The constellation mapper maps the bits and the constellation points for different modulation schemes like QPSK, BPSK, 16-QAM, and 64-QAM. Hence, there would be modulator blocks for performing the modulation. After modulating the signal, it is converted into the time domain and is transmitted as frames of data. These transmitted frames include a training structure, signal bits, cyclic prefixes and data bits.

20.3.3 Transmitter block diagram

HT-mixed format and HT-greenfield format transmissions can be generated using a transmitter consisting of of the following blocks:

a) *Scrambler* scrambles the data to reduce the probability of long sequences of zeros or ones; see 20.3.11.2.

b) *Encoder parser*, if BCC encoding is to be used, demultiplexes the scrambled bits among N_{ES} (number of BCC encoders for the Data field) BCC encoders, in a round robin manner.

c) *FEC encoders* encode the data to enable error correction. An FEC encoder may include a binary convolutional encoder followed by a puncturing device, or it may include an LDPC encoder.

d) *Stream parser* divides the outputs of the encoders into blocks that are sent to different interleaver and mapping devices. The sequence of the bits sent to an interleaver is called a *spatial stream*.

e) *Interleaver* interleaves the bits of each spatial stream (changes order of bits) to prevent long sequences of adjacent noisy bits from entering the BCC decoder. Interleaving is applied only when BCC encoding is used.

f) *Constellation mapper* maps the sequence of bits in each spatial stream to constellation points (complex numbers).

g) *STBC* encoder spreads constellation points from N_{SS} spatial streams into N_{STS} space-time streams using a space-time block code. STBC is used only when $N_{SS} < N_{STS}$; see 20.3.11.8.1.

h) *Spatial mapper* maps space-time streams to transmit chains. This may include one of the following:

1) *Direct mapping*: Constellation points from each space-time stream are mapped directly onto the transmit chains (one-to-one mapping).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

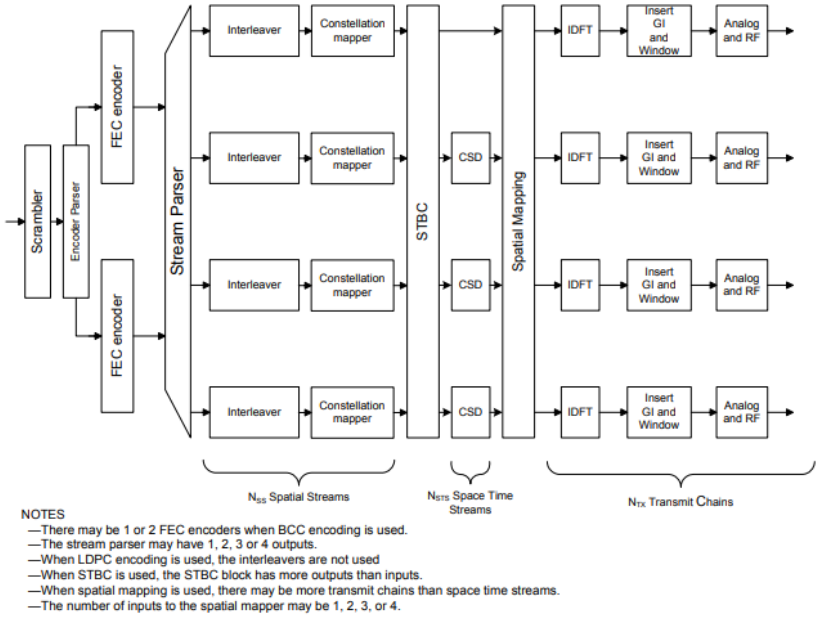


Figure 20-3—Transmitter block diagram 2

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

39. The accused products include one or more transmitting antennas in communication with the one or more OFDM modulators, respectively, each transmitting antenna configured to transmit the respective frame over a channel. The accused products support 802.11 a/b/g/n/ac WiFi standards and comprise one or more transmitting and one or more receiving antennas. These transmitting antennas transmit multiple OFDM frames with various signal fields over a channel. Thus, these transmitting antennas are connected to the OFDM modulators to obtain the OFDM frames for further transmission.

AC1300	AC1300	AC3000	AC3000
Home Wi-Fi Mesh Dual-Band Solution	Home Wi-Fi Mesh Dual-Band Solution Solution (2 Pack)	Home Wi-Fi Mesh Tri-Brand Solution	Home Wi-Fi Mesh Tri-Brand Solution Solution (2 Pack)
Access point covers up to 1,500 Sq Ft	Access point covers up to 3,000 Sq Ft	Access point covers up to 2,500 Sq Ft	Access point covers up to 5,000 Sq Ft
2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)
MU-MIMO	MU-MIMO	MU-MIMO	MU-MIMO
IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac

(Source : https://www.brkelectronics.com/secureconnect/)

The 802.11n-2009 wireless LAN standard provides Higher Throughput (HT) rates. These higher rates are achieved by a combination of MAC and PHY layer enhancements. The enhancements include:

- Reducing the per-packet overhead in the MAC layer.
- Allowing multiple MAC packets to be combined into a single PHY-layer burst.
- Allowing (optionally) a more efficient LDPC encoder.
- Allowing (optionally) a shorter guard interval (cyclic prefix) on the data symbols.
- Increasing the number of subcarriers used in the default 20 MHz physical channel.
- Providing an (optional) 40 MHz mode.
- Using MIMO techniques to broadcast multiple data streams over a single frequency channel.

By combining these techniques, the goal is to increase the usable data transfer rate by a factor of 10.

Signal Characteristics

The 802.11n standard uses OFDM modulation to transmit all data. It defines three operating modes:

(Source: http://rfmw.em.keysight.com/wireless/helpfiles/89600b/webhelp/subsystems/wlan-mimo/Content/mimo_80211n_overview.htm)

20.3.4 Overview of the PPDU encoding process

The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

40. The accused products include wherein the training structure of each frame includes a predetermined signal transmission matrix at a respective sub-channel, each training structure adjusted to have a substantially constant amplitude in a time domain, and the cyclic prefixes are further inserted within the training symbol, and wherein the cyclic prefixes within the training symbol are longer than the cyclic prefixes among the data symbols, thereby countering an extended channel impulse response and improving synchronization performance. For example, a space time matrix is part of the data symbols and the training symbols in the transmission data. This data is transmitted over different antennas. The WiFi standards use guard intervals while transmitting frames to help the synchronization of frames at the receiver end. These guard intervals are of different lengths for the preamble and data symbols. The screenshots below show the Guard interval in the Long Training Field is 1.6 micro seconds, and the data field uses a Short guard interval of 0.4 micro seconds, so the cyclic prefix for the training symbols is longer than the cyclic prefix for data symbols. The training symbols (L-STF, HT-STF fields) in the 802.11n preamble have a constant amplitude in the time domain.

p) Map each of the complex numbers in each of the N_{ST} subcarriers in each of the OFDM symbols in each of the N_{STS} space-time streams to the N_{TX} transmit chain inputs. For direct-mapped operation, $N_{TX} = N_{STS}$, and there is a one-to-one correspondence between space-time streams and transmit chains. In this case, the OFDM symbols associated with each space-time stream are also associated with the corresponding transmit chain. Otherwise, a spatial mapping matrix associated with each OFDM subcarrier, as indicated by the EXPANSION_MAT parameter of the TXVECTOR, is used to perform a linear transformation on the vector of N_{STS} complex numbers associated with each subcarrier in each OFDM symbol. This spatial mapping matrix maps the vector of N_{STS} complex numbers in each subcarrier into a vector of N_{TX} complex numbers in each subcarrier. The sequence of N_{ST} complex numbers associated with each transmit chain (where each of the N_{ST} complex numbers is taken from the same position in the N_{TX} vector of complex numbers across the N_{ST} subcarriers associated with an OFDM symbol) constitutes an OFDM symbol associated with the corresponding transmit chain. For details, see 20.3.11.10. Spatial mapping matrices may include cyclic shifts, as described in 20.3.11.10.1.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

T_{DFT}: IDFT/DFT period	3.2 µs	3.2 µs	3.2 µs
T_{GI}: Guard interval duration	0.8 µs= T_{DFT}/4	0.8 µs	0.8 µs
T_{GI2}: Double guard interval	1.6 µs	1.6 µs	1.6 µs
T_{GIS}: Short guard interval duration	N/A	0.4 µs = T_{DFT}/8	0.4 µs See NOTE 2
$T_{L\text{-}STF}$: Non-HT short training sequence duration	8 µs=10× T_{DFT}/4	8 µs	8 µs
$T_{HT\text{-}GF\text{-}STF}$: HT-greenfield short training field duration	N/A	8 µs=10× T_{DFT}/4	8 µs See NOTE 2
$T_{L\text{-}LTF}$: Non-HT long training field duration	8 µs=2× T_{DFT}+T_{GI2}	8 µs	8 µs
T_{SYM}: Symbol interval	4 µs= T_{DFT}+T_{GI}	4 µs	4 µs
T_{SYMS}: Short GI symbol interval	N/A	3.6 µs = T_{DFT}+T_{GIS}	3.6 µs See NOTE 2

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

STBC	2	Set to a nonzero number, to indicate the difference between the number of space-time streams (N_{STS}) and the number of spatial streams (N_{SS}) indicated by the MCS. Set to 00 to indicate no STBC (N_{STS} = N_{SS}). See NOTE 1.
FEC coding	1	Set to 1 for LDPC. Set to 0 for BCC.
Short GI	1	Set to 1 to indicate that the short GI is used after the HT training. Set to 0 otherwise.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

20.3.11.10.5 Transmission with a short GI

Short GI is used in the data field of the packet when the Short GI field in the HT-SIG is set to 1. When it is used, the same formula for the formation of the signal shall be used as in 20.3.11.10.2, 20.3.11.10.3, and 20.3.11.10.4, with T_{GI} replaced by T_{GIS} and T_{SYM} replaced by T_{SYMS}.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

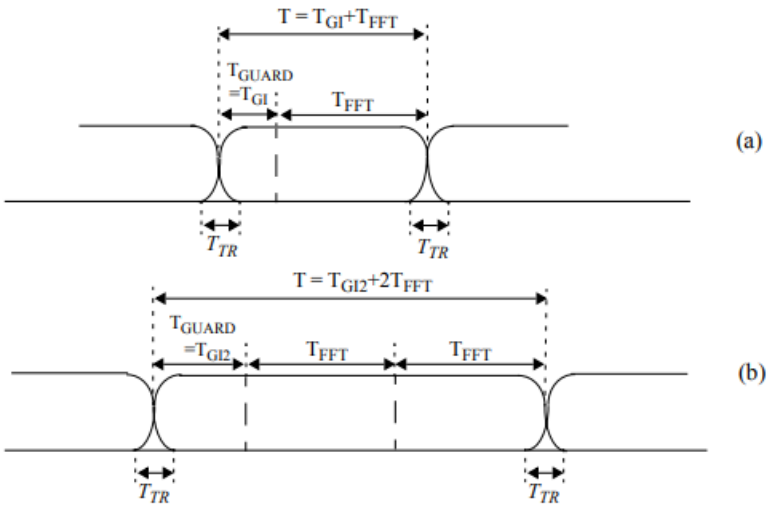
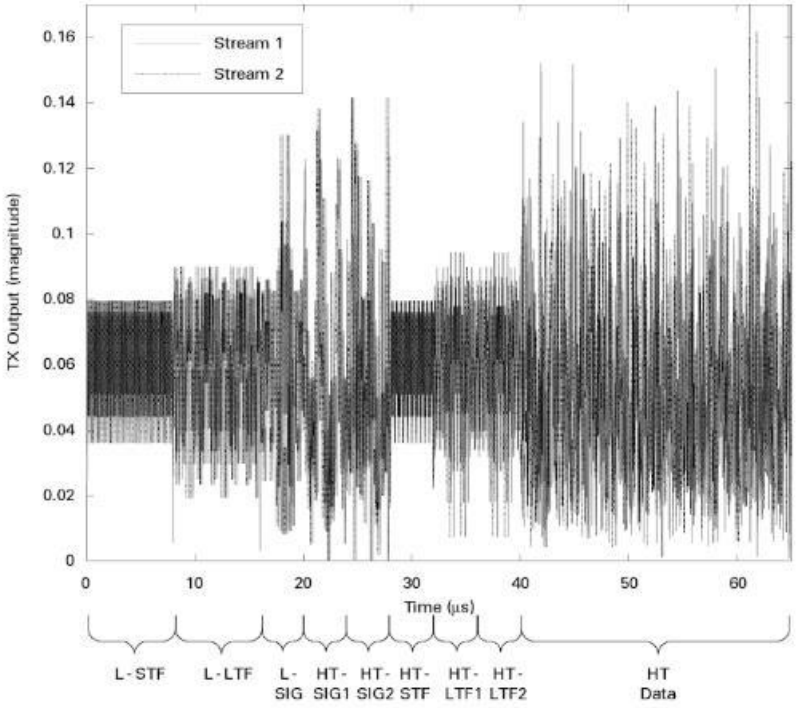


Figure 108—Illustration of OFDM frame with cyclic extension and windowing for (a) single reception or (b) two receptions of the FFT period

(Source: http://www.ahltek.com/WhitePaperspdf/802.11-20%20specs/802.11a-1999.pdf)



802.11n MF with two spatial streams.

(Source: Next Generation Wireless LANs: 802.11n and 802.11ac, Perahia, Eldad and Stacey, Robert)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

41. Newell has had actual knowledge of the '304 Patent at least as of the date when it was notified of the filing of this action. By the time of trial, Newell will have known and intended (since receiving such notice) that its continued actions would infringe and actively

induce and contribute to the infringement of one or more claims of the '304 Patent.

ANSWER: BRK admits that it has had knowledge of the '304 patent as of the date that BRK was served with a copy of Plaintiff's Complaint. BRK denies the remaining allegations of this paragraph of the Complaint.

42. Newell has also indirectly and willfully infringed, and continues to indirectly and willfully infringe, the '304 Patent, as explained further below in the "Additional Allegations Regarding Infringement" section.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

43. American Patents has been damaged as a result of the infringing conduct by Newell alleged above. Thus, Newell is liable to American Patents in an amount that adequately compensates it for such infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

44. American Patents and/or its predecessors-in-interest have satisfied all statutory obligations required to collect pre-filing damages for the full period allowed by law for infringement of the '304 Patent.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

COUNT III
[ALLEGED] DIRECT INFRINGEMENT OF U.S. PATENT NO. 7,706,458

45. On April 27, 2010, United States Patent No. 7,706,458 ("the '458 Patent") was duly and legally issued by the United States Patent and Trademark Office for an invention entitled "Time And Frequency Synchronization In Multi-Input, Multi-Output (MIMO) Systems."

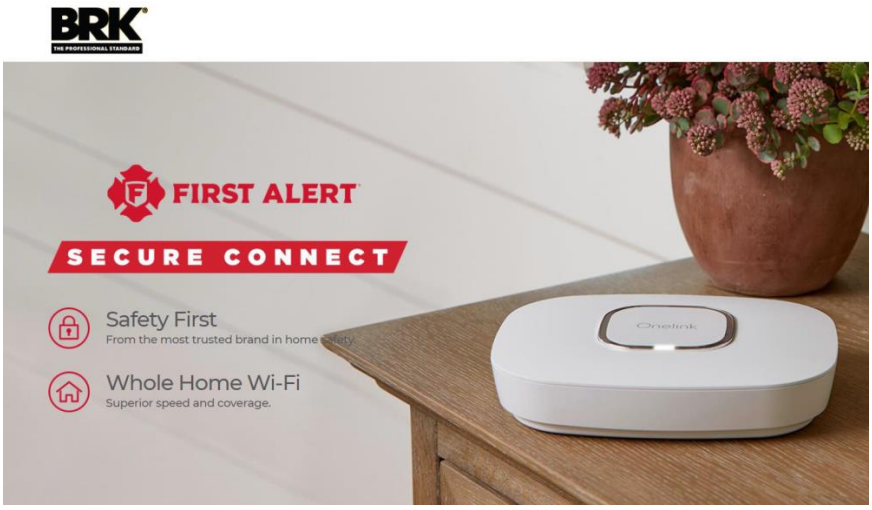
ANSWER: BRK admits that United States Patent No. 7,706,458 ("the '458 patent") is entitled "Time and Frequency Synchronization in Multi- Input, Multi-Output (MIMO) Systems" and shows as being issued by the USPTO on April 27, 2010. BRK is without knowledge or information sufficient to form a belief as to the truth of the remaining

allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

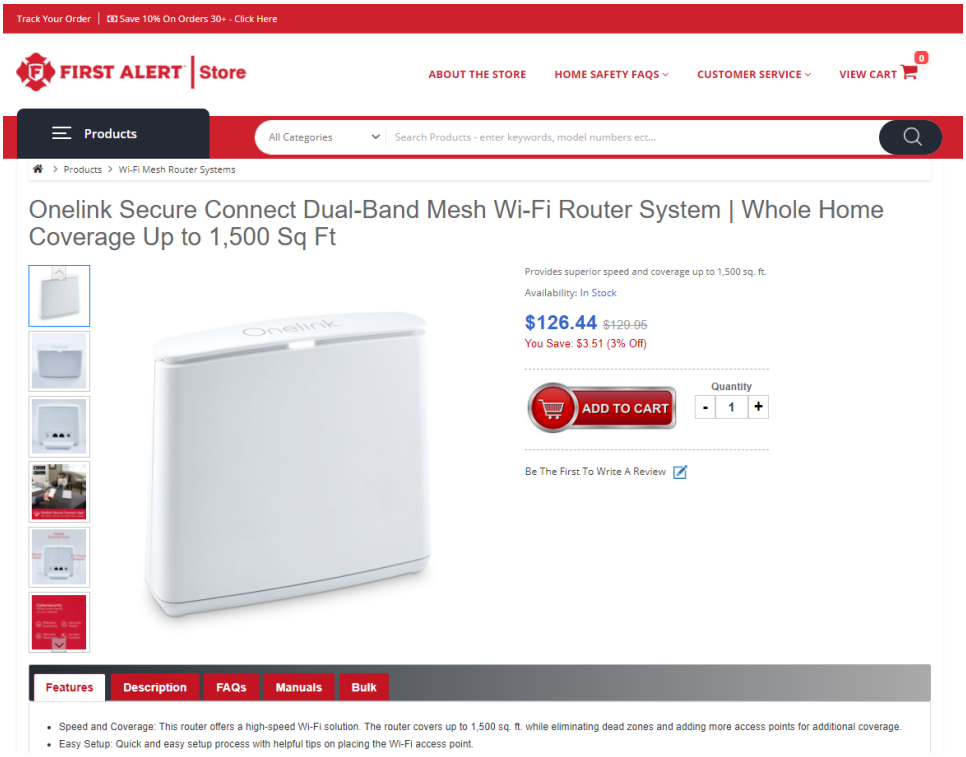
46. American Patents is the owner of the '458 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the '458 Patent against infringers, and to collect damages for all relevant times.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

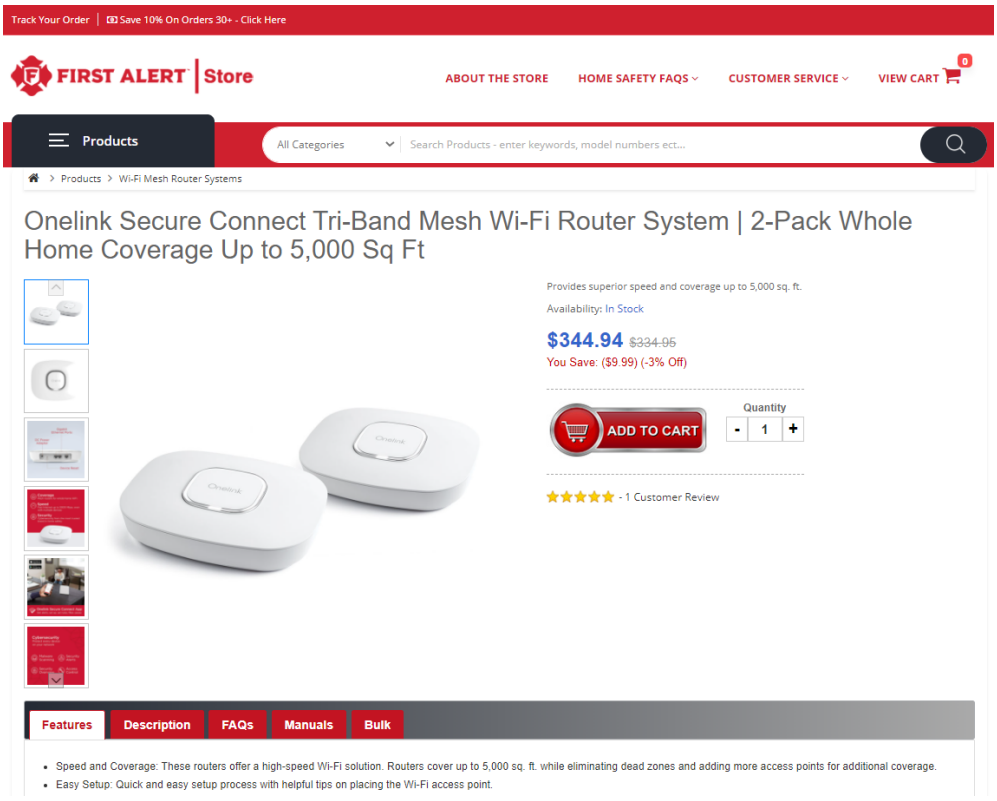
47. Newell made, had made, used, imported, provided, supplied, distributed, sold, and/or offered for sale products and/or systems including, for example, its First Alert/Onelink Secure Connect AC1300 Home Wi-Fi Mesh Dual Band Solution and First Alert/Onelink Secure Connect AC3000 Home Wi-Fi Mesh Tri-Band Solution families of products that include 802.11n and above capabilities ("accused products"):



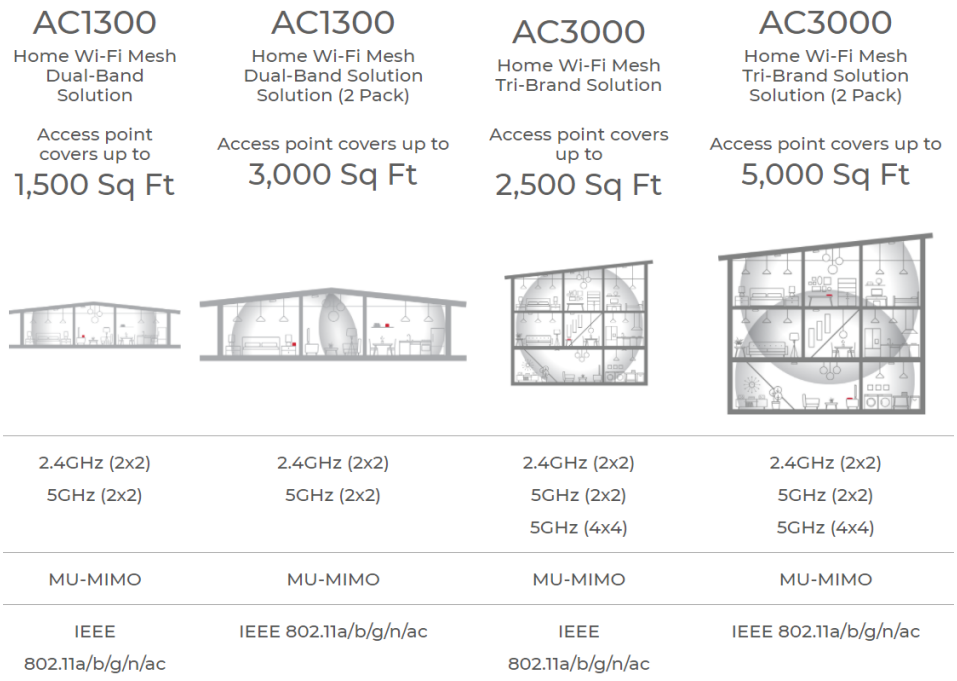
(Source : https://www.brkelectronics.com/secureconnect/)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-dual-band-mesh-wi-fi-router-system-1042081.htm)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-tri-band-mesh-wi-fi-router-system-2-pack-1042396.htm)



(Source : https://www.brkelectronics.com/secureconnect/)

ANSWER: The allegations of the paragraph are too vague to be understood, and BRK therefore lacks knowledge or information to form a belief about the truth of the remaining allegations in this paragraph of the Complaint and therefore denies the same.

48. By doing so, Newell has directly infringed (literally and/or under the doctrine of equivalents) at least Claim 1 of the '458 Patent. Newell's infringement in this regard is ongoing.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

49. Newell has infringed the '458 Patent by making, having made, using, importing, providing, supplying, distributing, selling or offering for sale products including an apparatus for synchronizing a communication system. For example, the accused products can act and have acted as a receiver in an apparatus for synchronizing a communication system. An 802.11 n/ac compliant WiFi access point that is communicating with an accused product can be part of the apparatus, acting as a transmitter. The accused products support IEEE 802.11 n/ac standards and MIMO technology. The IEEE 802.11ac standard is backwards compatible with the 802.11n standard. If a device such as an accused product complies with IEEE 802.11ac, it also complies

with IEEE 802.11n and all prior versions of the WiFi standards (802.11 a/b/g/n). According to the 802.11a standard, the physical layer services include an OFDM system. According to the IEEE 802.11n standard, all Protocol Data Unit (PPDU) frame formats have training fields and signaling fields which would help in synchronizing the communication system.

The introduction of 802.11ac expands the compatibility matrix in the 5 GHz band from two concurrently operating technologies to three, and the compatibility considerations in a broadcast network medium extend not only to intended receivers but to any receiver. Table 3-4 describes the compatibility between transmitters of frames and their intended receivers. That is, if a transmitter of the type in the left column sends a frame directed to a receiver of the type in any of the other three columns, what will the result be? One of the major methods used to support coexistence is backward compatibility. When built, 802.11ac devices will also incorporate 802.11a and 802.11n data rates, and thus will be able to send to older peers at older data rates.

(Source: 802.11ac: A Survival Guide: Wi-Fi at Gigabit and Beyond, Gast, Matthew S.)

Table 3-5. Compatibility between transmitters and listening devices

Transmitter type	802.11a listener	802.11n listener	802.11ac listener
802.11a	Designed operation	802.11n devices listen to 802.11a frames and defer medium access to avoid collisions	802.11ac devices listen to 802.11a frames and defer medium access to avoid collisions
802.11n	802.11n greenfield frames require RTS/CTS or CTS-to-self protection; 802.11n mixed-mode frames require no special protection	Designed operation	802.11ac devices listen to 802.11n frames and defer medium access to avoid collisions
802.11ac	802.11ac uses a compatible physical preamble, allowing 802.11a devices to read the medium as busy and avoid collisions	802.11ac uses a compatible preamble, allowing 802.11n devices to read the medium as busy and avoid collisions	Designed operation

(Source: 802.11ac: A Survival Guide: Wi-Fi at Gigabit and Beyond, Gast, Matthew S.)

17.1.1 Scope

This subclause describes the PHY services provided to the IEEE 802.11 wireless LAN MAC by the 5 GHz (bands) OFDM system. The OFDM PHY layer consists of two protocol functions, as follows:

a) A PHY convergence function, which adapts the capabilities of the physical medium dependent (PMD) system to the PHY service. This function is supported by the physical layer convergence procedure (PLCP), which defines a method of mapping the IEEE 802.11 PHY sublayer service data units (PSDU) into a framing format suitable for sending and receiving user data and management information between two or more stations using the associated PMD system.

b) A PMD system whose function defines the characteristics and method of transmitting and receiving data through a wireless medium between two or more stations, each using the OFDM system.

(Source: https://standards.ieee.org/standard/802_11a-1999.html)

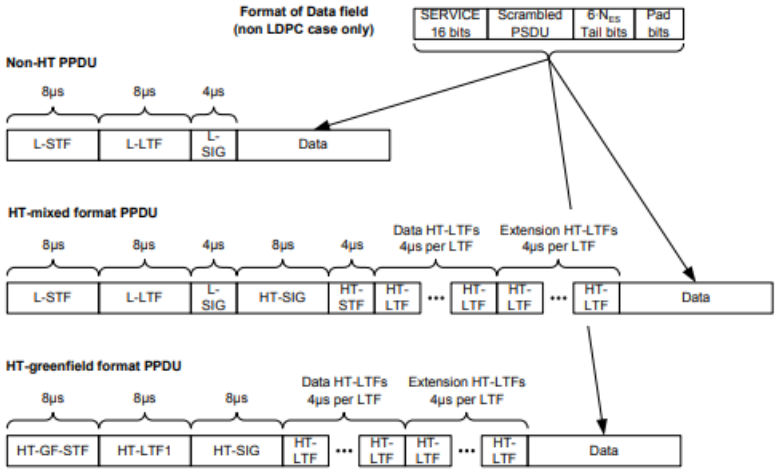


Figure 20-1—PPDU format

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The fields of the VHT PPDU format are summarized in Table 22-4.

Table 22-4—Fields of the VHT PPDU

Field	Description
L-STF	Non-HT Short Training field
L-LTF	Non-HT Long Training field
L-SIG	Non-HT SIGNAL field
VHT-SIG-A	VHT Signal A field
VHT-STF	VHT Short Training field
VHT-LTF	VHT Long Training field
VHT-SIG-B	VHT Signal B field
Data	The Data field carries the PSDU(s)

(Source: https://ieeexplore.ieee.org/document/7797535/)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

50. The accused products include a number (Q) of Orthogonal Frequency Division Multiplexing (OFDM) modulators, each OFDM modulator producing a frame having at least one inserted symbol, a plurality of data symbols, and cyclic prefixes. According to the IEEE 802.11n standard, a transmitter block contains different functional blocks which include, but are not limited to, constellation mappers, IDFT stage, and Guard interval insertion. Constellation mappers map the bits and the constellation points for different modulation schemes like QPSK, BPSK, 16-QAM, 64-QAM. After modulating the signal, it is converted into time domain and is transmitted as frames of data. These transmitted frames include training field bits, signal bits, cyclic prefixes and data bits. Alternatively, on request from an accused product, an 802.11 n/ac compliant WiFi access point can act as a transmitter that includes a number (Q) of OFDM modulators, each OFDM modulator producing a frame having

at least one inserted symbol, a plurality of data symbols, and cyclic prefixes.

20.3.3 Transmitter block diagram

HT-mixed format and HT-greenfield format transmissions can be generated using a transmitter consisting of of the following blocks:

a) *Scrambler* scrambles the data to reduce the probability of long sequences of zeros or ones; see 20.3.11.2.

b) *Encoder parser*, if BCC encoding is to be used, demultiplexes the scrambled bits among N_{ES} (number of BCC encoders for the Data field) BCC encoders, in a round robin manner.

c) *FEC encoders* encode the data to enable error correction. An FEC encoder may include a binary convolutional encoder followed by a puncturing device, or it may include an LDPC encoder.

d) *Stream parser* divides the outputs of the encoders into blocks that are sent to different interleaver and mapping devices. The sequence of the bits sent to an interleaver is called a *spatial stream*.

e) *Interleaver* interleaves the bits of each spatial stream (changes order of bits) to prevent long sequences of adjacent noisy bits from entering the BCC decoder. Interleaving is applied only when BCC encoding is used.

f) *Constellation mapper* maps the sequence of bits in each spatial stream to constellation points (complex numbers).

g) *STBC* encoder spreads constellation points from N_{SS} spatial streams into N_{STS} space-time streams using a space-time block code. STBC is used only when $N_{SS} < N_{STS}$; see 20.3.11.8.1.

h) *Spatial mapper* maps space-time streams to transmit chains. This may include one of the following:

1) *Direct mapping*: Constellation points from each space-time stream are mapped directly onto the transmit chains (one-to-one mapping).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

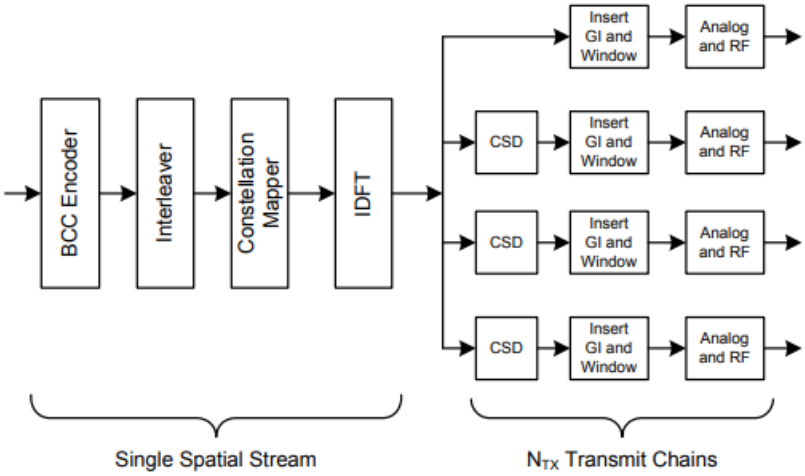
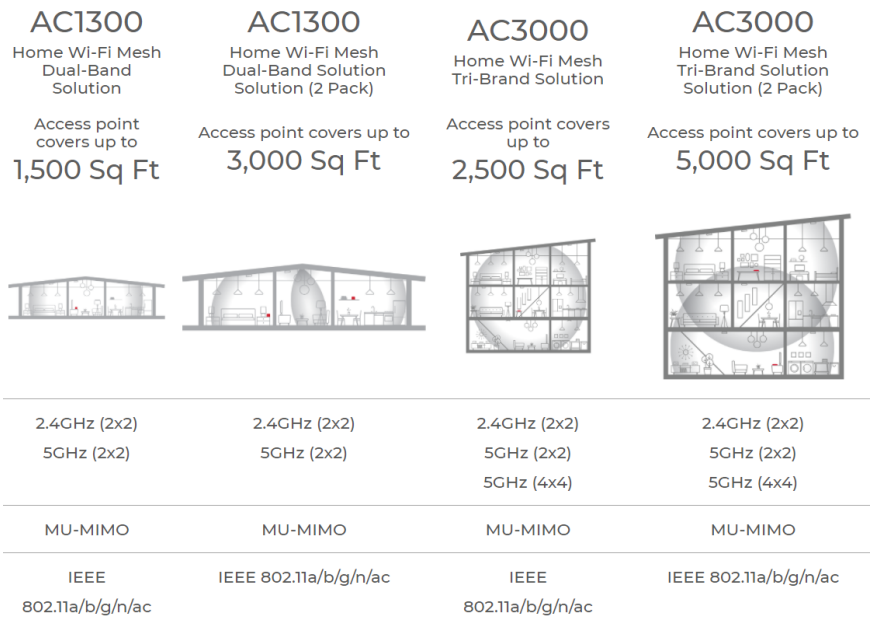


Figure 20-2—Transmitter block diagram 1

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

51. The accused products include Q transmitting antennas, each transmitting antenna connected to a respective OFDM modulator, the transmitting antennas configured to transmit a respective frame over a channel. The accused products support MIMO and comply with IEEE 802.11 a/b/g/n/ac standards. The transmitting antennas transmit multiple OFDM frames over a channel. The transmitting antennas are connected to OFDM modulators to transmit the OFDM frames over a channel. Alternatively, on request from an accused product, a WiFi access point acts as a device that includes Q transmitting antennas, each transmitting antenna connected to a respective OFDM modulator, the transmitting antennas configured to transmit a respective frame over a channel.



(Source : https://www.brkelectronics.com/secureconnect/)

20.3.4 Overview of the PPDU encoding process

The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

52. The accused products include a number (L) of receiving antennas for receiving the transmitted frames. For example, the accused products support MIMO and comply with 802.11 a/b/g/n/ac WiFi standards. The receiving antennas receive the transmitted frames.

AC1300 Home Wi-Fi Mesh Dual-Band Solution	AC1300 Home Wi-Fi Mesh Dual-Band Solution Solution (2 Pack)	AC3000 Home Wi-Fi Mesh Tri-Brand Solution	AC3000 Home Wi-Fi Mesh Tri-Brand Solution Solution (2 Pack)
Access point covers up to 1,500 Sq Ft	Access point covers up to 3,000 Sq Ft	Access point covers up to 2,500 Sq Ft	Access point covers up to 5,000 Sq Ft
2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)	2.4GHz (2x2) 5GHz (2x2) 5GHz (4x4)
MU-MIMO	MU-MIMO	MU-MIMO	MU-MIMO
IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac	IEEE 802.11a/b/g/n/ac

(Source : https://www.brkelectronics.com/secureconnect/)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

53. The accused products include L OFDM demodulators, each OFDM demodulator corresponding to a respective receiving antenna, the L OFDM demodulators including a synchronization circuit that processes the received frame in order to synchronize the received frame in both time domain and frequency domain. For example, there is a demodulator block for performing demodulation on the received frames. Further, synchronizing the received frame in time and frequency domains occurs. In an OFDM transmitter section, a modulated signal is converted into time domain and is transmitted as multiple frames of data. The functional blocks present at the receiver end processes the received data, converts the data into frequency domain, and performs demodulation. Various signal bits present in the transmitted frames' preamble helps in demodulating the signal. A demodulator block is present at the receiver to perform demodulation. Different fields of data like training bits, cyclic prefixes and other signal bits present in the received frame helps in synchronizing the frame in both time and frequency domain. There is a synchronization circuit which processes the received frame and synchronizes them in both time and frequency domain.

20.3.1 Introduction

A convergence procedure, in which PSDUs are converted to and from PPDUs, is provided for the HT PHY in 20.3. During transmission, the PSDU is processed (i.e., scrambled and coded) and appended to the PLCP preamble to create the PPDU. At the receiver, the PLCP preamble is processed to aid in demodulation and delivery of the PSDU.

Two preamble formats are defined. For HT-mixed format operation, the preamble has a non-HT portion and an HT portion. The non-HT portion of the HT-mixed format preamble enables detection of the PPDU and acquisition of carrier frequency and timing by both HT STAs and STAs that are compliant with Clause 17 and/or Clause 19. The non-HT portion of the HT-mixed format preamble also consists of the SIGNAL field defined in Clause 17 and is thus decodable by STAs compliant with Clause 17 and Clause 19 as well as HT STAs.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

3.244 receive chain: The physical entity that implements any necessary signal processing to provide the received signal to the digital baseband. Such signal processing includes filtering, amplification, down-conversion, and sampling.

3.245 sounding: The use of preamble training fields to measure the channel for purposes other than demodulation of the Data portion of the physical layer convergence procedure (PLCP) protocol data unit (PPDU) containing the training fields.

NOTE—These uses include calculation of transmit steering, calculation of recommended MCS, and calculation of calibration parameters.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

a) Detect the start of frame.

b) Detect the transition from short sequences to channel estimation sequences, and establish fine timing (with one sample resolution).

c) Estimate the coarse and fine frequency offsets.

d) Derotate the frame according to estimated frequency offset.

e) Estimate the complex channel response coefficients for each of the subcarriers and each of the transmit chains.

f) For each of the data OFDM symbols, transform the symbol into subcarrier received values, estimate the phase from the pilot subcarriers in all spatial streams, derotate the subcarrier values according to estimated phase, group the results from all the receiver chains in each subcarrier to a vector, multiply the vector by a zero-forcing equalization matrix generated from the channel estimated during the channel estimation phase.

g) For each data-carrying subcarrier in each spatial stream, find the closest constellation point and compute the Euclidean distance from it.

h) Compute the average of the RMS of all errors in a frame. It is given by Equation (20-89).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

54. The accused products include wherein each of the L OFDM demodulators comprises a pre-amplifier, a local oscillator, a mixer having a first input and a second input, the first input connected to an output of the pre-amplifier, the second input connected to an output of the local oscillator, an analog-to-digital converter (ADC) connected to an output of the mixer. The demodulating section at the receiver end includes a pre-amplifier, a local oscillator, a mixer, and an ADC. The received frames undergo filtering, amplification (pre-amplifier), down-conversion and sampling (ADC). There are respective functional blocks for performing these functions. After transmitting the data, the data is received by a receiving antenna for further processing. To prevent the demodulator from demodulating the noise associated with the received signal, an RF front end circuit is implemented to increase the SNR of the demodulated signal. The RF front end circuit generally consists of amplifiers, local oscillator, filters and mixers. The output from the mixer is generally fed to an analog-to-digital converter

(ADC). This RF front end circuit generally lies at the start of the demodulation process.

3.244 receive chain: The physical entity that implements any necessary signal processing to provide the received signal to the digital baseband. Such signal processing includes filtering, amplification, down-conversion, and sampling.

3.245 sounding: The use of preamble training fields to measure the channel for purposes other than demodulation of the Data portion of the physical layer convergence procedure (PLCP) protocol data unit (PPDU) containing the training fields.

NOTE—These uses include calculation of transmit steering, calculation of recommended MCS, and calculation of calibration parameters.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The technique to combat a low SNR_{demod_in} is by adding a front end block, which processes (conditions) the received signal/AWGN/interference before admitting it to the demodulator. This processing can be done in several ways:

(Source: VLSI for Wireless Communication)

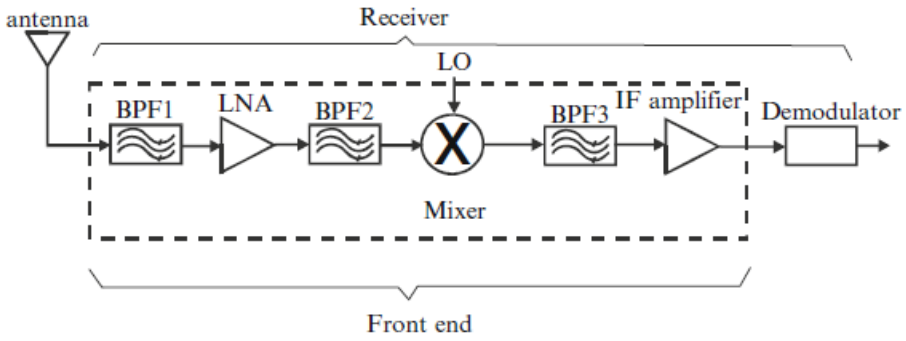


Fig. 2.2 RF receiver using a heterodyne architecture

(Source: VLSI for Wireless Communication)

2.4 Rest of Receiver Front End: Nonidealities and Design Parameters

Now that we have talked about the design of filters in the receiver front, we turn our attention to the design of the rest of the components. Normally these components consist of circuits such as LNA, mixer, IF amplifier, and analog/digital (A/D) converter. Unlike filters, their relevant design parameters are different. Hence our first task is to discuss these design parameters.

(Source: VLSI for Wireless Communication)

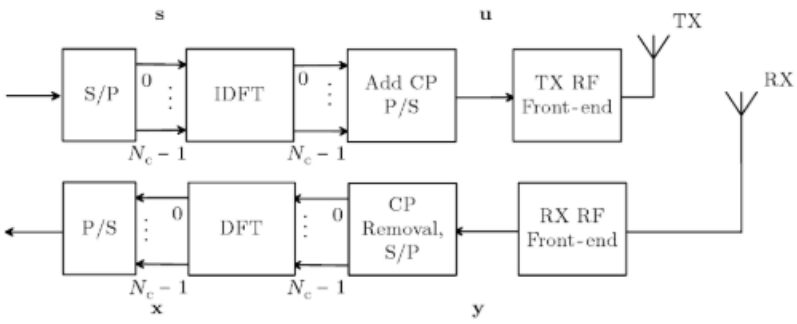


Figure 2.7. OFDM system model.

(Source: RF Imperfections in High-rate Wireless Systems: Impact and Digital Compression, Schenk, Tim)

The RF front end is generally defined as everything between the antenna and the digital baseband system. For a receiver, this "between" area includes all the filters, low-noise amplifiers (LNAs), and down-conversion mixer(s) needed to process the modulated signals received at the antenna into signals suitable for input into the baseband analog-to-digital converter (ADC). For this reason, the RF front end is often called the analog-to-digital or RF-to-baseband portion of a receiver.

(Source: https://www.eetimes.com/document.asp?doc_id=1276331)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

55. The accused products include the synchronization circuit having one input connected to an output of the ADC. The PPDU frames that are transmitted are demodulated at the receiver end. The demodulation process includes estimating time and frequency offsets and synchronizing accordingly.

a) Detect the start of frame.
b) Detect the transition from short sequences to channel estimation sequences, and establish fine timing (with one sample resolution).
c) Estimate the coarse and fine frequency offsets.
d) Derotate the frame according to estimated frequency offset.
e) Estimate the complex channel response coefficients for each of the subcarriers and each of the transmit chains.
f) For each of the data OFDM symbols, transform the symbol into subcarrier received values, estimate the phase from the pilot subcarriers in all spatial streams, derotate the subcarrier values according to estimated phase, group the results from all the receiver chains in each subcarrier to a vector, multiply the vector by a zero-forcing equalization matrix generated from the channel estimated during the channel estimation phase.
g) For each data-carrying subcarrier in each spatial stream, find the closest constellation point and compute the Euclidean distance from it.
h) Compute the average of the RMS of all errors in a frame. It is given by Equation (20-89).

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

The RF front end is generally defined as everything between the antenna and the digital baseband system. For a receiver, this "between" area includes all the filters, low-noise amplifiers (LNAs), and down-conversion mixer(s) needed to process the modulated signals received at the antenna into signals suitable for input into the baseband analog-to-digital converter (ADC). For this reason, the RF front end is often called the analog-to-digital or RF-to-baseband portion of a receiver.

(Source: https://www.eetimes.com/document.asp?doc_id=1276331)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

56. The accused products include a cyclic-prefix remover connected to an output of the synchronization circuit, a serial-to-parallel converter connected to an output of the cyclic prefix remover, and a discrete Fournier transform (DFT) stage connected to an output of the serial-to-parallel converter, an output of the DFT stage connected to another input to the synchronization circuit. Cyclic prefixes are added in the preamble for each transmitted frame. In a general OFDM system, a cyclic prefix remover circuit would be present at the receiver end. The output from the cyclic prefix remover circuit would be fed to a serial-to-parallel converter for performing a DFT operation on its output. The evidence also shows that the output of the DFT stage is connected to the phase correction block that is part of the synchronization circuit.

The encoding process is composed of the steps described below. The following overview is intended to facilitate an understanding of the details of the convergence procedure:

a) Determine the number of transmit chains, N_{TX}, from the N_TX field of the TXVECTOR. Produce the PLCP preamble training fields for each of the N_{TX} transmit chains based on the FORMAT, NUM_EXTEN_SS, CH_BANDWIDTH, and MCS parameters of the TXVECTOR. The format and relative placement of the PLCP preamble training fields vary depending on the frame format being used, as indicated by these parameters. Apply cyclic shifts. Determine spatial mapping to be used for HT-STF and HT-LTFs in HT-mixed format frame and HT-GF-STF and HT-LTFs in HT-greenfield format frame from the EXPANSION_MAT parameter of the TXVECTOR. Refer to 20.3.9 for details.

b) Construct the PLCP preamble SIGNAL fields from the appropriate fields of the TXVECTOR by adding tail bits, applying convolutional coding, formatting into one or more OFDM symbols, applying cyclic shifts, applying spatial processing, calculating an inverse Fourier transform for each OFDM symbol and transmit chain, and prepending a cyclic prefix or GI to each OFDM symbol in each transmit chain. The number and placement of the PLCP preamble SIGNAL fields depend on the frame format being used. Refer to 20.3.9.3.5, 20.3.9.4.3, and 20.3.9.5.3.

c) Concatenate the PLCP preamble training and SIGNAL fields for each transmit chain one field after another, in the appropriate order, as described in 20.3.2 and 20.3.7.

(Source: http://luci.subsignal.org/~jow/802.11n-2009.pdf)

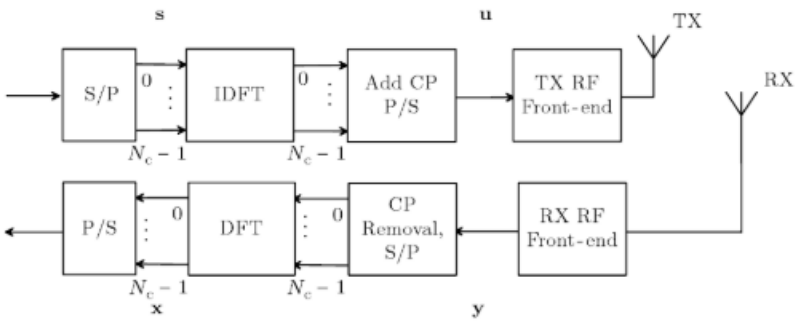


Figure 2.7. OFDM system model.

(Source: RF Imperfections in High-rate Wireless Systems: Impact and Digital Compression, Schenk, Tim)

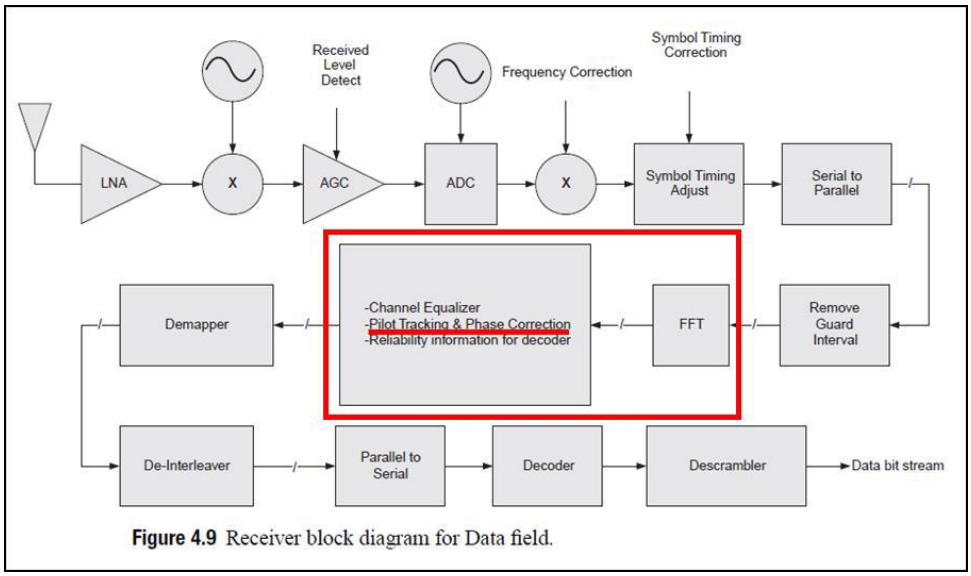


Figure 4.9 Receiver block diagram for Data field.

(Source: Next Generation Wireless LANs: 802.11n and 802.11ac, Perahia, Eldad and Stacey, Robert)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

57. Newell has had actual knowledge of the '458 Patent at least as of the date when it was notified of the filing of this action. By the time of trial, Newell will have known and intended (since receiving such notice) that its continued actions would infringe and actively induce and contribute to the infringement of one or more claims of the '458 Patent.

ANSWER: BRK admits that it has had knowledge of the '458 patent as of the date that BRK was served with a copy of Plaintiff's Complaint. BRK denies the remaining allegations of this paragraph of the Complaint.

58. Newell has also indirectly and willfully infringed, and continues to indirectly and willfully infringe, the '458 Patent, as explained further below in the "Additional Allegations Regarding Infringement" section.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

59. American Patents has been damaged as a result of the infringing conduct by Newell alleged above. Thus, Newell is liable to American Patents in an amount that adequately compensates it for such infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

60. American Patents and/or its predecessors-in-interest have satisfied all statutory obligations required to collect pre-filing damages for the full period allowed by law for infringement of the '458 Patent.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

COUNT IV
[ALLEGED] DIRECT INFRINGEMENT OF U.S. PATENT NO. 6,847,803

61. On January 25, 2005, United States Patent No. 6,847,803 ("the '803 Patent") was duly and legally issued by the United States Patent and Trademark Office for an invention entitled "Method for Reducing Interference in a Receiver."

ANSWER: BRK admits that United States Patent No. 6,847,803 ("the '803 patent") is entitled "Method for Reducing Interference in a Receiver" and shows as being issued by the USPTO on January 25, 2005. BRK is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

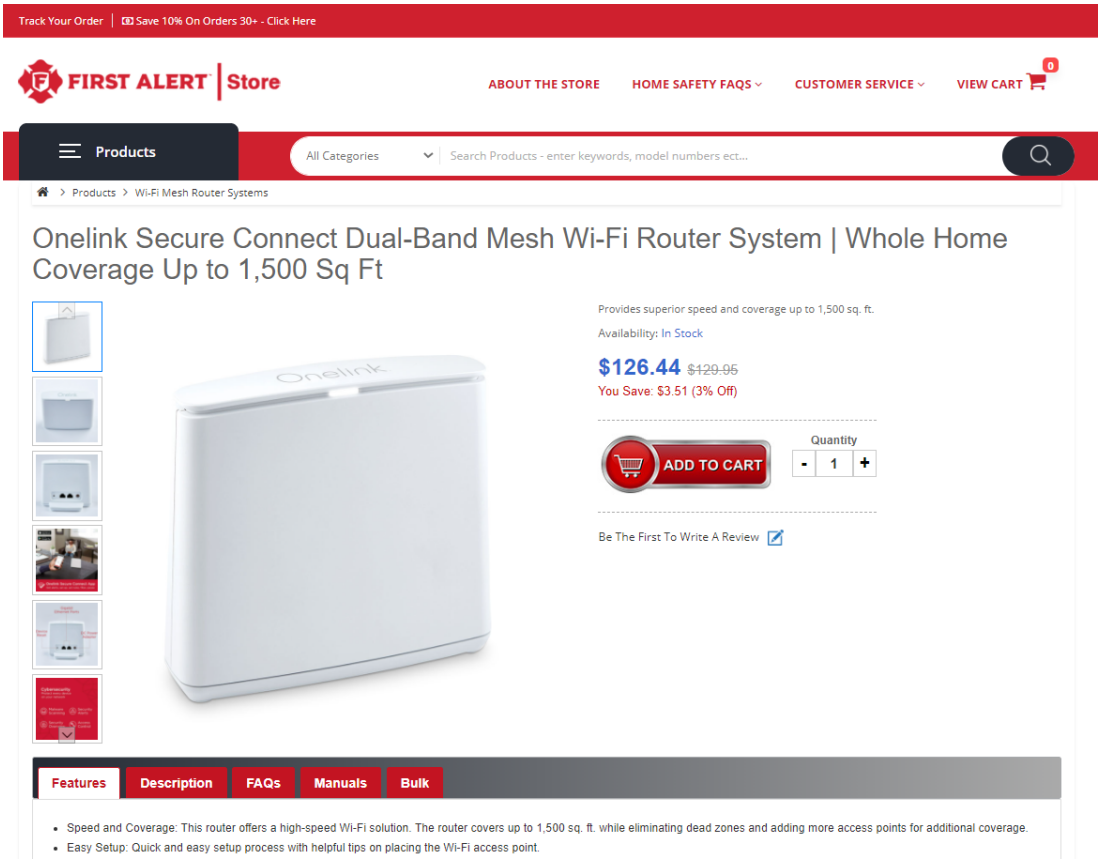
62. American Patents is the owner of the '803 Patent, with all substantive rights in and to that patent, including the sole and exclusive right to prosecute this action and enforce the '803 Patent against infringers, and to collect damages for all relevant times.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to

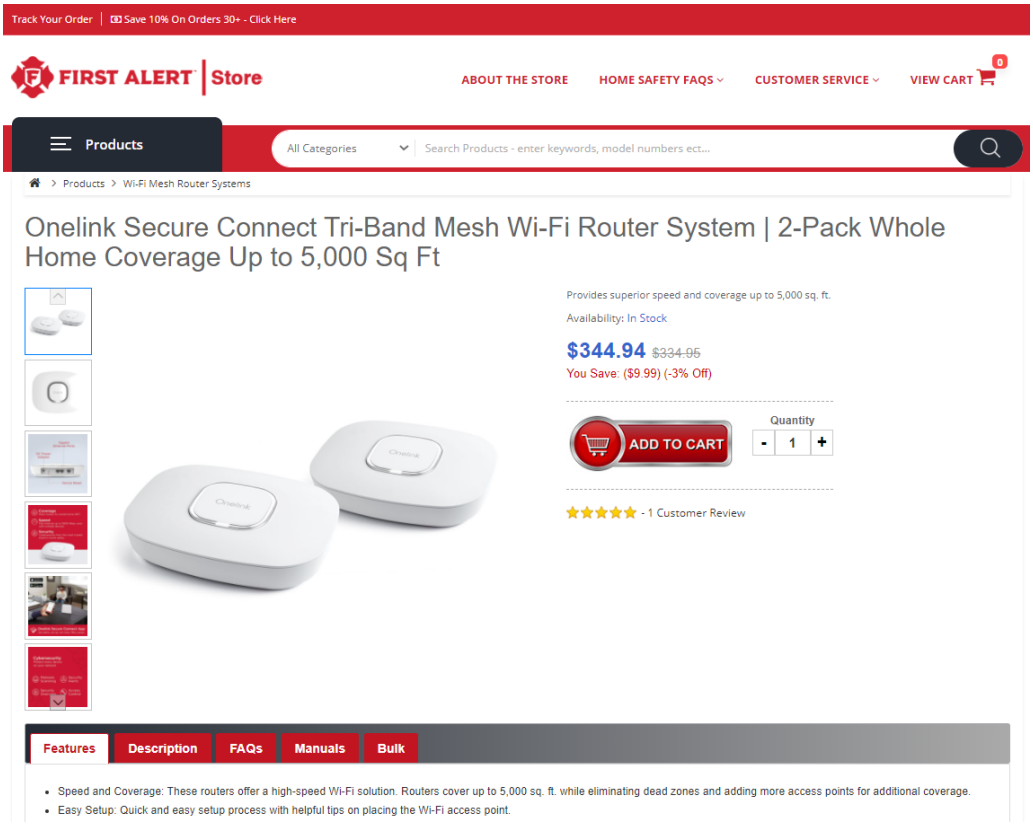
the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

63. Newell made, had made, used, imported, provided, supplied, distributed, sold, and/or offered for sale products and/or systems including, for example, its First Alert/Onelink Secure Connect AC1300 Home Wi-Fi Mesh Dual Band Solution and First Alert/Onelink Secure Connect AC3000 Home Wi-Fi Mesh Tri-Band Solution families of products, that include 802.11ac beamforming capabilities ("accused products"):

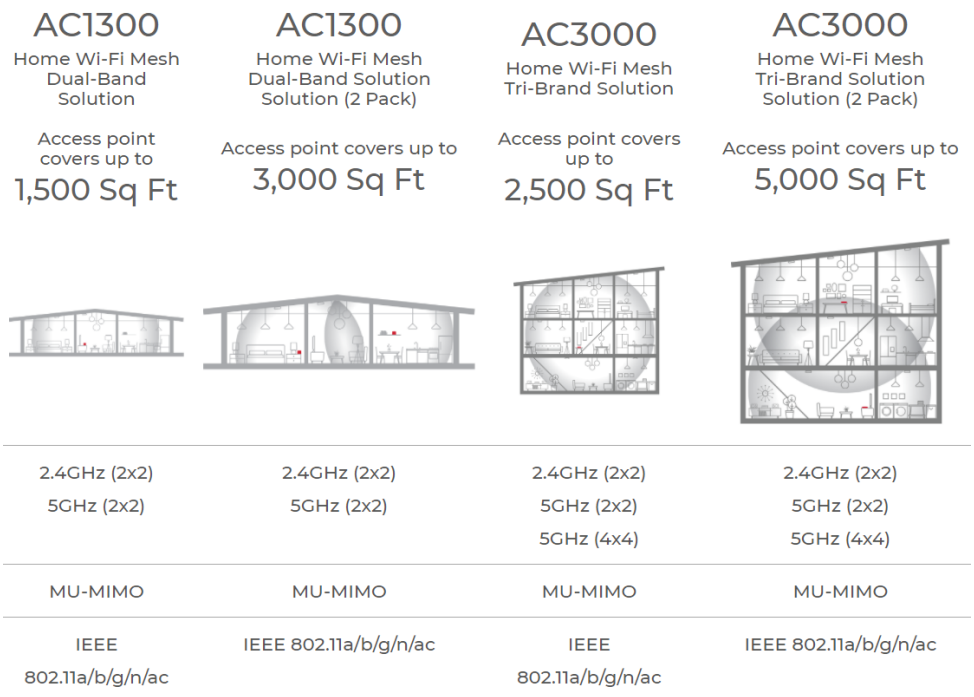
(Source : https://www.brkelectronics.com/secureconnect/)



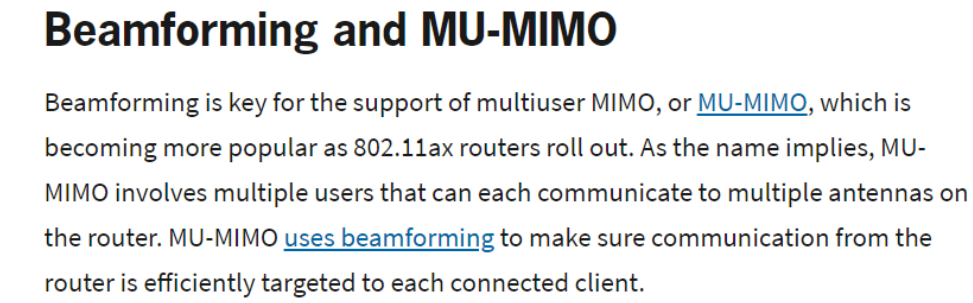
(Source：https://www.firstalertstore.com/store/products/onelink-secure-connect-dual-band-mesh-wi-fi-router-system-1042081.htm)



(Source : https://www.firstalertstore.com/store/products/onelink-secure-connect-tri-band-mesh-wi-fi-router-system-2-pack-1042396.htm)



(Source : https://www.brkelectronics.com/secureconnect/)



Beamforming and MU-MIMO

Beamforming is key for the support of multiuser MIMO, or MU-MIMO, which is becoming more popular as 802.11ax routers roll out. As the name implies, MU-MIMO involves multiple users that can each communicate to multiple antennas on the router. MU-MIMO uses beamforming to make sure communication from the router is efficiently targeted to each connected client.

(Source: https://www.networkworld.com/article/3445039/beamforming-explained-how-it-makes-wireless-communication-faster.html)

ANSWER: The allegations of the paragraph are too vague to be understood, and BRK therefore lacks knowledge or information to form a belief about the truth of the remaining allegations in this paragraph of the Complaint and therefore denies the same.

64. By doing so, Newell has directly infringed (literally and/or under the doctrine of equivalents) at least Claim 1 of the '803 Patent.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

65. Newell has infringed the '803 Patent by using the accused products and thereby practicing a method for reducing interference in a receiver for receiving information in receiving time slots, in which receiver signals are received with at least a first antenna (ANT1) and a second antenna (ANT2). For example, the accused products are and have been used by Defendant to implement the IEEE 802.11-2016 Standard, whose requirements were in effect five years before the Complaint. Devices that can communicate using 802.11 protocol are known as Stations (STAs). Multiple Input Multiple Output (MIMO) and Beamforming techniques are and have been used by a STA with multiple antennas for steering the signals to each STA ("receiver") for reception. In such MIMO transmissions, the space-time streams in the transmitted signal would be intended for reception by each STA in its corresponding time slots. These time slots at which the STA receives the space-time streams with actual data information can be construed as receiving time slots. Since, there are multiple antennas, when they transmit simultaneously, the signal appears as interference at each of the receive antennas. Further, a STA will also be able to identify the space-time streams intended for other STAs that act as interference. STA uses the channel state information that is obtained by estimating a channel to reduce the interference caused by other space time streams. The beamforming calibration procedures ("method for reducing interference") involves channel estimation and matrix calculations which help in reducing the interference in a receiver. Indeed, the IEEE 802.11-2016 Standard shows MIMO systems with two STAs (i.e., STA A and STA B) using multiple antennas ("a first antenna (ANT1) and a second antenna (ANT2)") for receiving transmitted signals.

21.3.11.1 General

SU-MIMO and DL-MU-MIMO beamforming are techniques used by a STA with multiple antennas (the beamformer) to steer signals using knowledge of the channel to improve throughput. With SU-MIMO beamforming all space-time streams in the transmitted signal are intended for reception at a single STA. With DL-MU-MIMO beamforming, disjoint subsets of the space-time streams are intended for reception at different STAs.

(Source : IEEE 802.11-2016 Standard, p. 2578)

19.3.12 Beamforming

19.3.12.1 General

Beamforming is a technique in which the beamformer utilizes the knowledge of the MIMO channel to generate a steering matrix Q_k that improves reception in the beamformee.

(Source : IEEE 802.11-2016 Standard, p. 2392)

A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended for the STA and can also be used to measure the channel for the interfering space-time streams. To successfully demodulate the space-time streams intended for the STA, the STA may use the channel state information for all space-time streams to reduce the effect of interfering space-time streams.

(Source : IEEE 802.11-2016 Standard, p. 2580)

(2) (**STA**tion) A client device in an 802.11 (Wi-Fi) wireless network such as a computer, laptop or smartphone. The term STA is sometimes used for the access point (AP) as well, in which case a STA is any device communicating via the 802.11 protocol. See wireless LAN and access point.

(Source : https://www.pcmag.com/encyclopedia/term/sta)

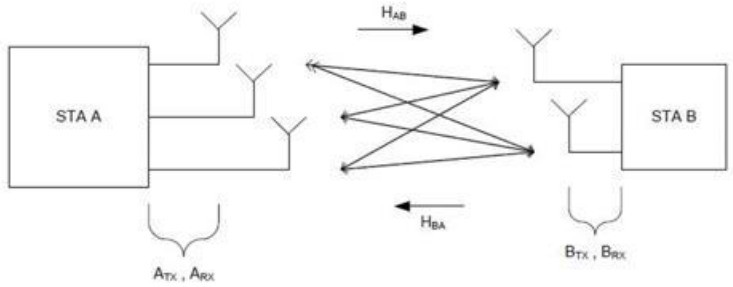


Figure 19-14—Beamforming MIMO channel model (3x2 example)

(Source : IEEE 802.11-2016 Standard, p. 2393)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

66. The methods practiced by Newell's use of the accused products include methods where signals are received with said first antenna (ANT1) and second antenna (ANT2) at moments of time other than in said receiving time slot, when no information is being received. For example, the accused products are and have been used by Defendant to implement the IEEE 802.11-2016 Standard, whose requirements were in effect five years before the Complaint. A STA in that Standard transmits data in PHY Protocol Data Units (PPDUs).

PPDUs can be transmitted in High Throughput (HT) mode and Very High Throughput (VHT) mode. A Null Data Packet (NDP) can be transmitted in both HT and VHT Modes. Training Fields (TFs) inside the NDP carry no data related information and can be used as sounding PPDUs in beamforming calibration procedures. Sounding PPDUs would help in channel estimation at the STA. Certain TFs include the interference information which is used as reference during calibration procedures. The NDPs ("signals received") in HT-PPDU and VHT PPDU format includes several TFs which are and have been used as a reference for the receiver to perform calibration/tuning. Thus, there is no actual data information that is received during the beamforming calibration procedures ("at moments of time other than in said receiving time slots").

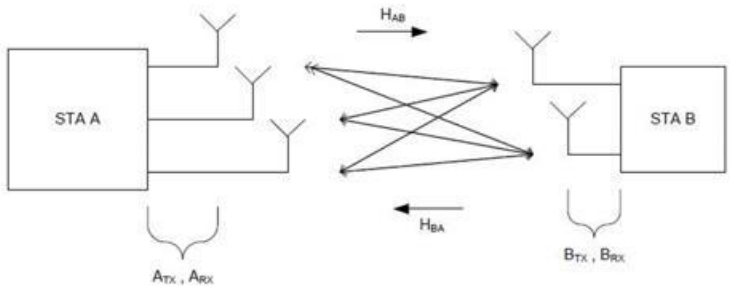


Figure 19-14—Beamforming MIMO channel model (3x2 example)

(Source : IEEE 802.11-2016 Standard, p. 2393)

Table 19-5—Elements of the HT PPDU

Element	Description
L-STF	Non-HT Short Training field
L-LTF	Non-HT Long Training field
L-SIG	Non-HT SIGNAL field
HT-SIG	HT SIGNAL field
HT-STF	HT Short Training field
HT-GF-STF	HT-Greenfield Short Training field
HT-LTF1	First HT Long Training field (Data)
HT-LTFs	Additional HT Long Training fields (Data and Extension)
Data	The Data field includes the PSDU

(Source : IEEE 802.11-2016 Standard, p. 2347)

Table 21-4—Fields of the VHT PPDU

Field	Description
L-STF	Non-HT Short Training field
L-LTF	Non-HT Long Training field
L-SIG	Non-HT SIGNAL field
VHT-SIG-A	VHT Signal A field
VHT-STF	VHT Short Training field
VHT-LTF	VHT Long Training field
VHT-SIG-B	VHT Signal B field
Data	The Data field carrying the PSDU(s)

The VHT-SIG-A, VHT-STF, VHT-LTF, and VHT-SIG-B fields exist only in VHT PPDUs. In a VHT NDP the Data field is not present. The number of symbols in the VHT-LTF field, N_{VHTLTF}, can be either 1, 2, 4, 6, or 8 and is determined by the total number of space-time streams across all users being transmitted in the VHT PPDU (see Table 21-13).

(Source : IEEE 802.11-2016 Standard, p. 2514)

In both HT-mixed format and HT-greenfield format frames, there are two types of HT-LTFs: Data HT-LTFs (HT-DLTFs) and Extension HT-LTFs (HT-ELTFs). HT-DLTFs are always included in HT PPDUs to provide the necessary reference for the receiver to form a channel estimate that allows it to demodulate the data

(Source : IEEE 802.11-2016 Standard, p. 2347)

null data packet (NDP): A physical layer (PHY) protocol data unit (PPDU) that carries no Data field.

off-channel: A channel used by a tunneled direct link setup (TDLS) station (STA) that does not overlap the channel(s) used by the access point (AP) with which the TDLS STA is associated.

(Source : IEEE 802.11-2016 Standard, p. 157)

sounding physical layer (PHY) protocol data unit (PPDU): A PPDU that is intended by the transmitting station (STA) to enable the receiving STA to estimate the channel between the transmitting STA and the receiving STA. The Not Sounding field in the High Throughput SIGNAL field (HT-SIG) is equal to 0 in sounding PPDUs.

(Source : IEEE 802.11-2016 Standard, p. 163)

21.3.12 VHT preamble format for sounding PPDUs

NDP is the only VHT sounding format.

The format of a VHT NDP PPDU is shown in Figure 21-28.

Figure 21-28—VHT NDP format

NOTE—The number of VHT-LTF symbols in the NDP is determined by the SU NSTS field in VHT-SIG-A.

The VHT NDP PPDU has the following properties:

— Uses the VHT PPDU format but without the Data field.
— Is a VHT SU PPDU as indicated by the VHT-SIG-A field.
— Has the data bits of the VHT-SIG-B field set to a fixed bit pattern (see 21.3.8.3.6).

(Source : IEEE 802.11-2016 Standard, p. 2580)

10.34 Null data packet (NDP) sounding

10.34.1 HT NDP sounding protocol

Sounding may be accomplished using either staggered sounding PPDU or HT NDP, as described in 19.3.13. The MAC rules associated with sounding using HT NDP are described in 10.34.1 to 10.34.4.

(Source : IEEE 802.11-2016 Standard, p. 1485)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

67. The methods practiced by Newell's use of the accused products include methods in which a reference signal representing interference in said other time slot is formed and used for the tuning of the receiver in said receiving time slots. For example, the accused products are and have been used by Defendant to implement the IEEE 802.11-2016 Standard, whose requirements were in effect five years before the Complaint. In that Standard, beamforming techniques are and have been used to improve the reception at a receiver STA. These techniques use the channel state information and generate steering matrices for the transmission of data. There are two types of beamforming methods described in the standard, Implicit feedback beamforming and Explicit feedback beamforming. A steering matrix, Qk, is calculated in both beamforming methods. Explicit feedback beamforming enables a beamformee i.e., receiving STA to calculate beamforming feedback matrix based on the received sounding packets/PPDUs. NDPs can be used as sounding PPDUs and hence, no data/information is received during the beamforming procedures. The Standard shows a scenario wherein STA A (transmit STA) transmits a sounding packet (which can be NDP PPDU) that is used by STA B (receiving STA) to calculate a beamforming feedback matrix Vk ("reference signal"). The feedback matrix is later sent to STA A for determining a steering matrix which is used to tune and re-calibrate the receiver STA in order to demodulate the transmitted signal. Implicit feedback beamforming enables STA to estimate a MIMO channel and calculate channel matrices, based on a received sounding PPDU. NDPs can be used as

sounding PPDUs and hence, no data/information is received during the beamforming procedures. The Standard shows a scenario wherein STA A and STA B (receiving STA) follow beamforming calibration procedures using sounding PPDUs. STA A and STA B will exchange sounding PPDUs (which can be NDP PPDUs), using which each of the STAs will estimate respective channel matrices. Quantized estimates of the channel matrices ("reference signal") are sent from STA B to STA A. Later, STA A uses its local estimates and the received quantized estimates from STA B to calculate set of correction matrices. These correction matrices that are formed using the received quantized estimates, are applied at transmit side of a STA to correct/tune the amplitude and phase differences in transmit and receive chains. All the above discussed steps are performed as a part of beamforming calibration procedures using sounding PPDUs. The Standard also shows equations for the received signal with beamforming. The channel estimates and beamforming steering matrix are and have been used to tune and re-calibrate the receiver in order to demodulate the transmitted signal.

19.3.12 Beamforming

19.3.12.1 General

Beamforming is a technique in which the beamformer utilizes the knowledge of the MIMO channel to generate a steering matrix Q_k that improves reception in the beamformee.

The equivalent complex baseband MIMO channel model is one in which, when a vector $\mathbf{x}_k = [x_1, x_2, \ldots x_{N_{TX}}]^T$ is transmitted in subcarrier k, the received vector $\mathbf{y}_k = [y_1, y_2, \ldots y_{N_{RX}}]^T$ is modeled as shown in Equation (19-62).

$$\mathbf{y}_k = H_k \mathbf{x}_k + \mathbf{n} \quad (19\text{-}62)$$

where

H_k is channel matrix of dimensions $N_{RX} \times N_{TX}$

$\mathbf{n}$ is white (spatially and temporally) Gaussian noise as illustrated in Figure 19-14

(Source : IEEE 802.11-2016 Standard, p. 2392-2393)

When beamforming is used, the beamformer replaces $\mathbf{x}_k$, which in this case has $N_{STS} \leq N_{TX}$ elements, with $Q_k \mathbf{x}_k$, where Q_k has N_{TX} rows and N_{STS} columns, so that the received vector is as shown in Equation (19-63).

$$\mathbf{y}_k = H_k Q_k \mathbf{x}_k + \mathbf{n} \quad (19\text{-}63)$$

The beamforming steering matrix that is computed (or updated) from a new channel measurement replaces the existing Q_k for the next beamformed data transmission. There are several methods of beamforming, differing in the way the beamformer acquires the knowledge of the channel matrices H_k and on whether the beamformer generates Q_k or the beamformee provides feedback information for the beamformer to generate Q_k.

(Source : IEEE 802.11-2016 Standard, p. 2393)

19.3.12.3 Explicit feedback beamforming

19.3.12.3.1 General

In explicit beamforming, in order for STA A to transmit a beamformed packet to STA B, STA B measures the channel matrices and sends STA A either the effective channel, $H_{eff,k}$, or the beamforming feedback matrix, V_k, for STA A to determine a steering matrix, $Q_{steer,k} = Q_k V_k$, with V_k found from $H_k Q_k$, where Q_k is the orthonormal spatial mapping matrix that was used to transmit the sounding packet that elicited the V_k feedback. The effective channel, $H_{eff,k} = H_k Q_k$, is the product of the spatial mapping matrix used on transmit with the channel matrix. When new steering matrix $Q_{steer,k}$ is found, $Q_{steer,k}$ may replace Q_k for the next beamformed data transmission.

NOTE—$Q_{steer,k}$ is a mathematical term to update a new steering matrix for Q_k in the next beamformed data transmission.

(Source : IEEE 802.11-2016 Standard, p. 1477)

10.32.3 Explicit feedback beamforming

The procedures in this subclause apply only to HT and non-HT PPDUs for which the HT Control field, if present, is the HT variant HT Control field.

In this subclause, the terms *HT beamformer* and *HT beamformee* refer to STAs that are involved in explicit feedback beamforming.

An HT beamformer uses the feedback response that it receives from the HT beamformee to calculate a beamforming feedback matrix for transmit beamforming. This feedback response may have one of three formats:

- *CSI*: The HT beamformee sends the MIMO channel coefficients to the HT beamformer.
- *Noncompressed beamforming*: The HT beamformee sends calculated beamforming feedback matrices to the HT beamformer.
- *Compressed beamforming*: The HT beamformee sends compressed beamforming feedback matrices to the HT beamformer.

(Source : IEEE 802.11-2016 Standard, p. 1477)

10.34 Null data packet (NDP) sounding

10.34.1 HT NDP sounding protocol

Sounding may be accomplished using either staggered sounding PPDU or HT NDP, as described in 19.3.13. The MAC rules associated with sounding using HT NDP are described in 10.34.1 to 10.34.4.

(Source : IEEE 802.11-2016 Standard, p. 1477)

10.34.5 VHT sounding protocol

10.34.5.1 General

Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the *VHT beamformer*, and a STA for which reception is optimized is called a *VHT beamformee*. An explicit feedback mechanism is used where the VHT beamformee directly measures the channel from the training symbols transmitted by the VHT beamformer and sends back a transformed estimate of the channel state to the VHT beamformer. The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive the steering matrix.

(Source : IEEE 802.11-2016 Standard, p. 1477)

21.3.12 VHT preamble format for sounding PPDUs

NDP is the only VHT sounding format.

The format of a VHT NDP PPDU is shown in Figure 21-28.

Figure 21-28—VHT NDP format

NOTE—The number of VHT-LTF symbols in the NDP is determined by the SU NSTS field in VHT-SIG-A.

The VHT NDP PPDU has the following properties:

— Uses the VHT PPDU format but without the Data field.
— Is a VHT SU PPDU as indicated by the VHT-SIG-A field.
— Has the data bits of the VHT-SIG-B field set to a fixed bit pattern (see 21.3.8.3.6).

(Source : IEEE 802.11-2016 Standard, p. 2580)

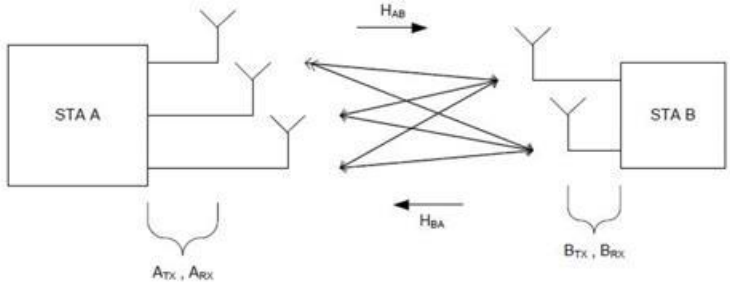


Figure 19-14—Beamforming MIMO channel model (3x2 example)

(Source : IEEE 802.11-2016 Standard, p. 2393)

Focusing on STA A, the procedure for estimating $K_{A,k}$ is as follows:

a) STA A sends STA B a sounding PPDU, the reception of which allows STA B to estimate the channel matrices $H_{AB,k}$.
b) STA B sends STA A a sounding PPDU, the reception of which allows STA A to estimate the channel matrices $\tilde{H}_{BA,k}$.
c) STA B sends the quantized estimates of $\tilde{H}_{AB,k}$ to STA A.
d) STA A uses its local estimates of $\tilde{H}_{BA,k}$ and the quantized estimates of $\tilde{H}_{AB,k}$ received from STA B to compute the correction matrices $K_{A,k}$.

(Source : IEEE 802.11-2016 Standard, p. 2395)

Figure 10-48 and Figure 10-49 illustrate the calibration PPDU exchange using NDPs.

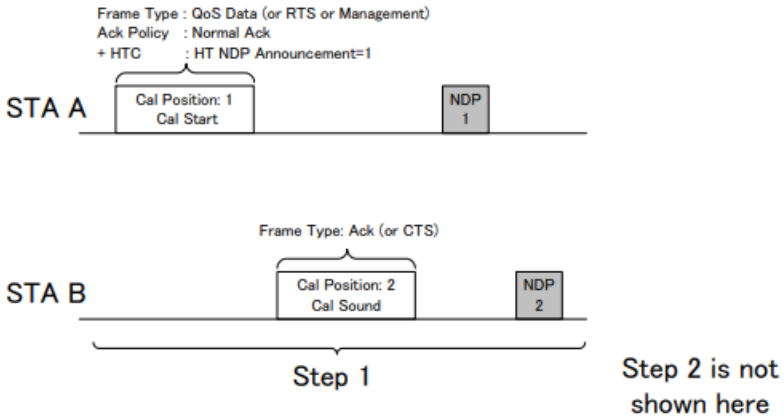


Figure 10-48—Calibration procedure with NDP

(Source : IEEE 802.11-2016 Standard, p. 1475)

21.3.12 VHT preamble format for sounding PPDUs

NDP is the only VHT sounding format.

The format of a VHT NDP PPDU is shown in Figure 21-28.

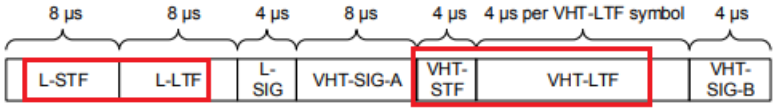


Figure 21-28—VHT NDP format

NOTE—The number of VHT-LTF symbols in the NDP is determined by the SU NSTS field in VHT-SIG-A.

The VHT NDP PPDU has the following properties:

— Uses the VHT PPDU format but without the Data field.
— Is a VHT SU PPDU as indicated by the VHT-SIG-A field.
— Has the data bits of the VHT-SIG-B field set to a fixed bit pattern (see 21.3.8.3.6).

(Source : IEEE 802.11-2016 Standard, p. 2580)

While the over-the-air channel between the antenna(s) at one STA and the antenna(s) at a second STA is reciprocal, the observed baseband-to-baseband channel used for communication might not be, as it includes the transmit and receive chains of the STAs. Differences in the amplitude and phase characteristics of the transmit and receive chains associated with individual antennas degrade the reciprocity of the over-the-air channel and cause degradation of performance of implicit beamforming techniques. The over-the-air calibration procedure described in 10.32.2.4 may be used to restore reciprocity. The procedure provides the means for calculating a set of correction matrices that can be applied at the transmit side of a STA to correct the amplitude and phase differences between the transmit and receive chains in the STA. If this correction is done at least at the STA that serves as the beamformer, there is sufficient reciprocity for implicit feedback in the baseband-to-baseband response of the forward link and reverse channel.

(Source : IEEE 802.11-2016 Standard, p. 2394)

19.3.13.3 Sounding PPDU for calibration

In the case of a bidirectional calibration exchange, two STAs exchange sounding PPDUs, the exchange of which enables the receiving STA to compute an estimate of the MIMO channel matrix H_k for each subcarrier k. In general, in an exchange of calibration messages, the number of spatial streams is less than the number of transmit antennas. In such cases, HT-ELTFs are used. In the case of sounding PPDUs for calibration, the antenna mapping matrix shall be as shown in Equation (19-86).

(Source : IEEE 802.11-2016 Standard, p. 2401)

Two preamble formats are defined. For HT-mixed format operation, the preamble has a non-HT portion and an HT portion. The non-HT portion of the HT-mixed format preamble enables detection of the PPDU and acquisition of carrier frequency and timing by both HT STAs and STAs that are compliant with Clause 17 and/or Clause 18. The non-HT portion of the HT-mixed format preamble also consists of the SIGNAL field defined in Clause 17 and is thus decodable by STAs compliant with Clause 17 and Clause 18 as well as HT STAs.

The HT portion of the HT-mixed format preamble enables estimation of the MIMO channel to support demodulation of the HT data by HT STAs. The HT portion of the HT-mixed format preamble also includes the HT-SIG field, which supports HT operation. The SERVICE field is prepended to the PSDU.

(Source : IEEE 802.11-2016 Standard, p. 2346)

19.3.12 Beamforming

19.3.12.1 General

Beamforming is a technique in which the beamformer utilizes the knowledge of the MIMO channel to generate a steering matrix Q_k that improves reception in the beamformee.

The equivalent complex baseband MIMO channel model is one in which, when a vector $\mathbf{x}_k = [x_1, x_2, \ldots x_{N_{TX}}]^T$ is transmitted in subcarrier k, the received vector $\mathbf{y}_k = [y_1, y_2, \ldots y_{N_{RX}}]^T$ is modeled as shown in Equation (19-62).

$$\mathbf{y}_k = H_k \mathbf{x}_k + \mathbf{n} \quad (19\text{-}62)$$

where

H_k is channel matrix of dimensions $N_{RX} \times N_{TX}$

$\mathbf{n}$ is white (spatially and temporally) Gaussian noise as illustrated in Figure 19-14

(Source : IEEE 802.11-2016 Standard, p. 2392-2393)

When beamforming is used, the beamformer replaces $\mathbf{x}_k$, which in this case has $N_{STS} \leq N_{TX}$ elements, with $Q_k \mathbf{x}_k$, where Q_k has N_{TX} rows and N_{STS} columns, so that the received vector is as shown in Equation (19-63).

$$\mathbf{y}_k = H_k Q_k \mathbf{x}_k + \mathbf{n} \quad (19\text{-}63)$$

The beamforming steering matrix that is computed (or updated) from a new channel measurement replaces the existing Q_k for the next beamformed data transmission. There are several methods of beamforming, differing in the way the beamformer acquires the knowledge of the channel matrices H_k and on whether the beamformer generates Q_k or the beamformee provides feedback information for the beamformer to generate Q_k.

(Source : IEEE 802.11-2016 Standard, p. 2393)

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

68. American Patents only asserts method claims from the ‘803 Patent.

ANSWER: This paragraph sets forth legal conclusions and questions of law to which no response is required. BRK is further without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

69. American Patents has been damaged as a result of the infringing conduct by Newell alleged above. Thus, Newell is liable to American Patents in an amount that adequately compensates it for such infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

70. American Patents and/or its predecessors-in-interest have satisfied all statutory obligations required to collect pre-filing damages for the full period allowed by law for infringement of the ‘803 Patent.

ANSWER: BRK is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

ADDITIONAL ALLEGATIONS REGARDING [ALLEGED] INFRINGEMENT

71. In addition to any specific products mentioned above, the accused products also include at least the following products: First Alert/Onelink Secure Connect AC1300 Home Wi-Fi Mesh Dual Band Solution, First Alert/Onelink Secure Connect AC3000 Home Wi-Fi Mesh Tri-Band Solution, Mesh WiFi Router System (two AC1300 and one AC3000), First Alert/Onelink Secure Connect Whole Home Wi-Fi Kit, First Alert Smart Alarm model 1042136, First Alert Smart Alarm model 1039102, First Alert Smart Alarm model AC10-500, First Alert Smart Alarm model DC10-500, First Alert Smart Alarm model 1042135, Onelink Safe & Sound (1040931), Onelink Smart Smoke & Co (1042135, 1042136, 1042137, and 1042138), First Alert Model AC10-500, First Alert Model AC10-500B, First Alert Model DC10-500, First Alert Model DC10-500B, First Alert Model 1036470, First Alert Model 1036515, First Alert Model 1042733, First Alert Model 1040530, Newell IP Camera DWIP-720, Coleman CHD400W 1296p HD WiFi Xtreme Trail Camera.

ANSWER: BRK incorporates by reference its answers to paragraphs 1–70 above. BRK admits that this paragraph of the Complaint identifies purported accused products. BRK

admits that it has offered for sale and/or sold at least some of the products identified in this paragraph, but denies infringement of any of Plaintiff's patents. Further, BRK denies that the products are properly accused products. BRK is without knowledge or information sufficient to form a belief as to the truth of any remaining allegations in this paragraph of the Complaint and, on that basis, denies all such allegations.

72. Newell has also indirectly infringed the '782 Patent, the '304 Patent, and the '458 Patent by inducing others to directly infringe the '782 Patent, the '304 Patent, and the '458 Patent. Newell has induced the end-users, Newell's customers, to directly infringe (literally and/or under the doctrine of equivalents) the '782 Patent, the '304 Patent, and the '458 Patent by using the accused products.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

73. Newell took active steps, directly and/or through contractual relationships with others, with the specific intent to cause them to use the accused products in a manner that infringes one or more claims of the patents-in-suit, including, for example, Claim 30 of the '782 Patent, Claim 1 of the '304 Patent, and Claim 1 of the '458 Patent.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

74. Such steps by Newell included, among other things, advising or directing customers and end-users to use the accused products in an infringing manner; advertising and promoting the use of the accused products in an infringing manner; and/or distributing instructions that guide users to use the accused products in an infringing manner.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

75. Newell has performed these steps, which constitute induced infringement, with the knowledge of the '782 Patent, the '304 Patent, and the '458 Patent and with the knowledge that the induced acts constitute infringement.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

76. Newell was and is aware that the normal and customary use of the accused products by Newell's customers would infringe the '782 Patent, the '304 Patent, and the '458 Patent. Newell's inducement is ongoing.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

77. Newell has also induced its affiliates, or third-party manufacturers, shippers, distributors, retailers, or other persons acting on its or its affiliates' behalf, to directly infringe (literally and/or under the doctrine of equivalents) the '782 Patent, the '304 Patent, and the '458 Patent by importing, selling, offering to sell, and/or using the accused products.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

78. Newell has at least a significant role in placing the accused products in the stream of commerce in Texas and elsewhere in the United States.

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint, and, on that basis, denies all such allegations.

79. Newell directs or controls the making of accused products and their shipment to the United States, using established distribution channels, for sale in Texas and elsewhere within the United States.

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint, and, on that basis, denies all such allegations.

80. Newell directs or controls the sale of the accused products into established United States distribution channels, including sales to nationwide retailers.

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint, and, on that basis, denies all such allegations.

81. Newell's established United States distribution channels include one or more

United States based affiliates (e.g., at least Newll Brands DTC, Inc., Newell Sales & Marketing Group, Inc., Newell Companies, Newell Rubbermaid, Inc.).

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint, and, on that basis, denies all such allegations.

82. Newell directs or controls the sale of the accused products nationwide on its own website as well as in nationwide retailers such as Amazon, Lowe's, Home Depot, Staples, Walmart, and Target, including for sale in Texas and elsewhere in the United States, and expects and intends that the accused products will be so sold.

ANSWER: The allegations of this paragraph are too vague to be understood, and BRK therefore lacks knowledge or information sufficient to form a belief as to the truth of those allegations in this paragraph of the Complaint, and, on that basis, denies all such allegations.

83. Newell took active steps, directly and/or through contractual relationships with others, with the specific intent to cause such persons to import, sell, or offer to sell the accused products in a manner that infringes one or more claims of the patents-in-suit, including, for example, Claim 30 of the '782 Patent, Claim 1 of the '304 Patent, and Claim 1 of the '458 Patent.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

84. Such steps by Newell included, among other things, making or selling the accused products outside of the United States for importation into or sale in the United States, or knowing that such importation or sale would occur; and directing, facilitating, or influencing its affiliates, or third-party manufacturers, shippers, distributors, retailers, or other persons acting on its or their behalf, to import, sell, or offer to sell the accused products in an infringing manner.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

85. Newell performed these steps, which constitute induced infringement, with the knowledge of the '782 Patent, the '304 Patent, and the '458 Patent and with the knowledge that the induced acts would constitute infringement.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

86. Newell performed such steps in order to profit from the eventual sale of the accused products in the United States.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

87. Newell's inducement is ongoing.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

88. Newell has also indirectly infringed by contributing to the infringement of the '782 Patent, the '304 Patent, and the '458 Patent. Newell has contributed to the direct infringement of the '782 Patent, the '304 Patent, and the '458 Patent by the end-user of the accused products.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

89. The accused products have special features that are specially designed to be used in an infringing way and that have no substantial uses other than ones that infringe the '782 Patent, the '304 Patent, and the '458 Patent, including, for example, Claim 30 of the '782 Patent, Claim 1 of the '304 Patent, and Claim 1 of the '458 Patent.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

90. As described above, the special features include improved wireless communication capabilities used in a manner that infringes the '782 Patent, the '304 Patent, and the '458 Patent.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

91. The special features constitute a material part of the invention of one or more of the claims of the '782 Patent, the '304 Patent, and the '458 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

92. Newell's contributory infringement is ongoing.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

93. Furthermore, Newell has a policy or practice of not reviewing the patents of others (including instructing its employees to not review the patents of others), and thus has been willfully blind of American Patents' patent rights. See, e.g., M. Lemley, "Ignoring Patents," 2008 Mich. St. L. Rev. 19 (2008).

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

94. Newell's actions are at least objectively reckless as to the risk of infringing valid patents and this objective risk was either known or should have been known by Newell.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

95. Newell has knowledge of the '782 Patent, the '304 Patent, and the '458 Patent.

ANSWER: BRK admits that it has had knowledge of the '782, '304, '458, and '803 patents ("the Asserted Patents") as of the date that BRK was served with a copy of Plaintiff's Complaint. BRK denies the remaining allegations of this paragraph of the Complaint.

96. Newell's customers have infringed the '782 Patent, the '304 Patent, and the '458 Patent.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

97. Newell encouraged its customers' infringement.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

98. Newell's direct and indirect infringement of the '782 Patent, the '304 Patent, and the '458 Patent is, has been, and/or continues to be willful, intentional, deliberate, and/or in conscious disregard of American Patents' rights under the patents.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

99. American Patents has been damaged as a result of the infringing conduct by Newell alleged above. Thus, Newell is liable to American Patents in an amount that adequately compensates it for such infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

ANSWER: BRK denies the allegations in this paragraph of the Complaint.

CLARIFICATION REGARDING PATENT EXPIRATION

100. For the avoidance of doubt, American Patents does not seek relief under any asserted patent for acts occurring after the expiration of that patent.

ANSWER: This paragraph contains legal conclusions for which no response is required.

[PLAINTIFF'S] JURY DEMAND

BRK admits that Plaintiff has demanded a trial by jury. To the extent that any allegations are included in the demand, BRK denies such allegations.

[PLAINTIFF'S] PRAYER FOR RELIEF

BRK denies the underlying allegations of Plaintiff's prayer for relief, denies that Plaintiff is entitled to any relief whatsoever, and requests that the Court deny all relief to Plaintiff and enter judgment in favor of BRK on all claims and award BRK its costs and reasonable attorney fees and any further relief as the Court may deem appropriate. To the extent that any allegations of the Complaint have not been previously specifically admitted or denied, BRK denies them.

GENERAL DENIAL

To the extent not previously addressed, BRK denies the remaining allegations and prayers in the Complaint.

BRK generally denies any allegations in the Complaint to which it did not specifically respond.

ADDITIONAL DEFENSES

BRK asserts the following Additional Defenses in response to Plaintiff's Complaint. Assertion of a defense is not a concession that BRK has the burden of proving the matter asserted. BRK reserves its right to amend its Answer to add more Additional Defenses, including instances of inequitable conduct, as they become known throughout the course of discovery in this case.

BRK additionally restates and incorporates by reference the facts and assertions contained in BRK's Counterclaims for Declaratory Relief.

FIRST DEFENSE

101. American Patents has failed to state a claim on which relief can be granted in particular with respect to, but without limitation to, any allegations of pre-suit willful infringement and pre-suit indirect infringement. BRK is not liable to American Patents for willful or indirect infringement for the acts alleged to have been performed before BRK knew of the Asserted Patents.

SECOND DEFENSE

102. BRK has not infringed, and does not infringe, either literally or under the doctrine of equivalents, any valid and enforceable claim of the Asserted Patents, whether directly, indirectly, individually, jointly, contributorily, and/or by inducement.

THIRD DEFENSE

103. The claims of the Asserted Patents are invalid and/or unenforceable at least because they fail to satisfy one or more of the conditions or requirements for patentability specified in Title 35 of the United States Code, including, without limitation, 35 U.S.C. §§ 101, 102, 103, and 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto.

FOURTH DEFENSE

104. Plaintiff's claims for relief are statutorily limited in whole or in part by Title 35 of the United States Code, including without limitation, 35 U.S.C. §§ 286 and/or 287.

FIFTH DEFENSE

105. 35 U.S.C. § 288 bars Plaintiff from recovering costs associated with this action.

SIXTH DEFENSE

106. Plaintiff's claims that BRK indirectly infringes the Asserted Patents either contributorily or by inducement, are barred, in whole or in part, because BRK is not liable to

Plaintiff for the allegedly infringing acts for any time periods during which BRK did not know of the Asserted Patents and/or did not have the specific intent to cause infringement of the Asserted Patents and/or otherwise did not know that its actions would constitute indirect infringement. In addition, any and all products or actions accused of infringement have substantial uses that do not infringe and do not induce or contribute to the infringement of the claims of the Asserted Patents.

SEVENTH DEFENSE

107. Plaintiff's claims of patent infringement are barred to the extent the alleged infringement is licensed, either expressly or impliedly, or otherwise authorized. Plaintiff's claims of patent infringement are also barred to the extent that Plaintiff has exhausted its rights and remedies as to the alleged infringement.

EIGHTH DEFENSE

108. Plaintiff's claims are barred by the doctrine of prosecution history estoppel, claim vitiation, and/or recapture based on statements, representations, and admissions made during the prosecution of the patent applications resulting in the Asserted Patents before the USPTO and/or during the prosecution of related patent applications.

NINTH DEFENSE

109. One or more of the Asserted Patents are unenforceable because of Plaintiff's and/or Plaintiff's predecessors' failure to disclose them to the applicable Standard-Setting Organizations ("SSOs").

110. For example, Dr. Apurva Mody is a named inventor of the '782, '304, and '458 patents. American Patents alleges that BRK has infringed the '782, '304, and '458 patents because the accused products support IEEE 802.11n/ac standards. Dr. Mody is listed as a member of the individual balloting committee that voted on the IEEE 802.11n standard. His

participation in the standard-setting process for IEEE 802.11n and 802.11ac came with an obligation to disclose any standards-essential patents. Based on Plaintiff's allegations in this matter, the '782, '304, and '458 patents are essential to the IEEE 802.11n/ac standards. On information and belief, Mody failed to disclose the '782, '304, and '458 patents prior to the voting, approval, and/or publication dates of IEEE 802.11 n/ac. This constitutes standard-setting misconduct, threatening continued harm to defendants and relevant third parties, rendering at least the '782, '304, and '458 patents unenforceable.

111. Further, on information and belief, the '782 patent, the '304 patent, and the '458 patent were previously assigned to BAE Systems, a member of the European Telecommunications Standards Institute ("ETSI"). Based on Plaintiff's allegations in other matters (e.g., *American Patents LLC v. Coolpad Group Limited* et al, No. 4:19-CV-877 (E.D. Tex.)), the '782, '304, and '458 patents are essential to the LTE standards (e.g., ETSI TS 136 331). To the extent that BAE Systems failed to disclose those patents as required by ETSI's Intellectual Property Rights policy, such violations render at least the '782, '304, and '458 patents unenforceable.

112. Similarly, Nokia, the predecessor-in-interest to the '803 Patent, identified numerous patents as essential to the 802.11 standard, including in relation to the 802.11ac standard, and beamforming technologies which are allegedly a contribution of the '803 Patent adopted by the 802.11ac standard. For example, Nokia made standards commitments for U.S. Patent Nos. 7,440,760, 8,422,961, and 6,298,035. On information and belief, if the '803 patent was a standards-essential patent as American Patents appears to allege, American Patents' predecessor-in-interest should have also made a standard commitment for the '803 patent. On information and belief, Nokia representatives participated in the drafting and approval of the 802.11ac standard but failed to disclose the '803 patent. This constitutes standard-setting

misconduct, threatening continued harm to BRK and relevant third parties, rendering the '803 patent unenforceable.

TENTH DEFENSE

113. As set forth above in BRK's Ninth Defense, which BRK incorporates as if set forth herein, on information and belief, Plaintiff's claims for monetary relief are limited or barred by its obligations to license the Asserted Patents on fair, reasonable, and non-discriminatory ("FRAND") terms and conditions pursuant to the relevant rules and intellectual property rights policies of the applicable SSOs. For example, at least one inventor of the asserted patents participated in standards setting meetings for the 802.11n standard, and failed to comply with his obligation to notify the standards setting organization and IEEE of his allegedly standards essential technology and patents. Further, Plaintiff filed this lawsuit without making any FRAND offer prior to suit and therefore violated its FRAND obligations. Plaintiff's failure to comply with its FRAND obligations limit or otherwise bar the damages, if any, available to Plaintiff in this action.

ELEVENTH DEFENSE

114. Plaintiff's claims are barred, in whole or in part, by equitable doctrines, including waiver, estoppel, acquiescence, patent misuse, laches, and/or unclean hands. BRK incorporates the statements and explanations set forth in its Ninth and Tenth Defenses. Further, Plaintiff has attempted to use its patent rights to obtain and coerce an unfair commercial advantage by attempting to extend the economic effect beyond the scope of the patent grant.

TWELFTH DEFENSE

115. Plaintiff cannot prove that this is an exceptional case justifying an award of attorney's fees against defendants pursuant to 35 U.S.C. § 285.

THIRTEENTH DEFENSE

116. Plaintiff cannot prove that it is entitled to injunctive relief because there exists an adequate remedy at law and Plaintiff's claims otherwise fail to meet the requirements of such relief.

RESERVATION OF RIGHTS

117. In filing these defenses, BRK has not knowingly or intentionally waived any applicable defenses. BRK reserves the right to assert and rely upon any other applicable defenses that may become available or apparent during the course of this action. BRK reserves the right to amend or to seek to amend its answer or affirmative defenses.

BRK'S COUNTERCLAIMS FOR DECLARATORY RELIEF

BRK incorporates by reference Paragraphs 1 through 117 of its responses to the Complaint as if fully set forth herein. For its counterclaims against American Patents, BRK alleges as follows:

NATURE OF ACTION

1. These counterclaims seek declaratory judgment with respect to the patents asserted by American Patents against BRK. BRK seeks judgment under the patent laws of the United States, 35 U.S.C. § 1 *et seq.*, and the Declaratory Judgment Act, 28 U.S.C. §§ 2201, 2202.

PARTIES

2. Counterclaimant BRK Brands, Inc. is a corporation established under the laws of the State of Delaware, with a principal place of business at 3901 Liberty Street Aurora, Illinois 60504.

3. Upon information and belief based solely on paragraph 1 of the Complaint as pled by American Patents, Counterclaim-Defendant American Patents LLC is a limited liability company formed under the laws of the State of Texas, with its principal place of business at 2325 Oak Alley, Tyler, Texas, 75703.

JURISDICTION AND VENUE

4. This Court has subject matter over these counterclaims pursuant to 28 U.S.C. §§ 1331, 1338(a), 2201, and 2202.

5. American Patents has consented to the personal jurisdiction of this Court at least by commencing its action for patent infringement in this District, as set forth in its Complaint.

6. By virtue of its filing this action, American Patents has also consented that venue

is permissible in this District, though not convenient for BRK, pursuant to at least 28 U.S.C. §§ 1391 and 1400.

COUNTERCLAIM I: DECLARATORY JUDGMENT OF NON-INFRINGEMENT OF U.S. PAT. NO. 7,088,782

7. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

8. Based on American Patents' filing of this action and at least BRK's Second Defense, an actual controversy has arisen and now exists between the parties as to whether BRK infringes the Asserted Patents.

9. BRK has not and is not now infringing any claim of the '782 Patent under any theory, including directly (whether individually or jointly) or indirectly (whether contributorily or by inducement).

10. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 *et seq.*, BRK requests a declaration by the Court that BRK has not infringed and does not infringe any valid and enforceable claim of the '782 Patent, whether directly, indirectly, individually, jointly, contributorily, and/or by inducement. BRK does not have an adequate remedy at law.

COUNTERCLAIM II: DECLARATORY JUDGMENT OF INVALIDITY OF U.S. PAT. NO. 7,088,782

11. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

12. Based on American Patents' filing of this action and at least BRK's Third Defense, an actual controversy has arisen and now exists between the parties as to the validity of the claims of the Asserted Patents.

13. The claims of the '782 Patent are invalid because the alleged inventions fail to

satisfy the conditions for patentability specified in 35 U.S.C. § 100 *et seq.*, including §§ 101, 102, 103, and/or 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto.

14. Pursuant to the Federal Declaratory Judgment Act, 28 U.S.C. § 2201 *et seq.*, and Title 35 of the United States Code, BRK requests a declaration by the Court that the claims of '782 Patent are invalid for failing to satisfy the conditions for patentability specified in 35 U.S.C. § 101 *et seq.*, including, without limitation, §§ 101, 102, 103, and/or 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto. BRK does not have an adequate remedy at law.

COUNTERCLAIM III: DECLARATORY JUDGMENT OF NON-INFRINGEMENT OF U.S. PAT. NO. 7,310,304

15. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

16. Based on American Patents' filing of this action and at least BRK's Second Defense, an actual controversy has arisen and now exists between the parties as to whether BRK infringes the Asserted Patents.

17. BRK has not and is not now infringing any claim of the '304 Patent under any theory, including directly (whether individually or jointly) or indirectly (whether contributorily or by inducement).

18. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that BRK has not infringed and does not infringe any valid and enforceable claim of the '304 Patent, whether directly, indirectly, individually, jointly, contributorily, and/or by inducement. BRK does not have an adequate remedy at law.

COUNTERCLAIM IV: DECLARATORY JUDGMENT OF INVALIDITY OF U.S. PAT. NO. 7,310,304

19. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

20. Based on American Patents' filing of this action and at least BRK's Third Defense, an actual controversy has arisen and now exists between the parties as to the validity of the claims of the Asserted Patents.

21. The claims of the '304 Patent are invalid because the alleged inventions fail to satisfy the conditions for patentability specified in 35 U.S.C. § 100 et seq., including §§ 101, 102, 103, and/or 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto.

22. Pursuant to the Federal Declaratory Judgment Act, 28 U.S.C. § 2201 et seq., and Title 35 of the United States Code, BRK requests a declaration by the Court that the claims of '304 Patent are invalid for failing to satisfy the conditions for patentability specified in 35 U.S.C. § 101 et seq., including, without limitation, §§ 101, 102, 103, and/or 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto. BRK does not have an adequate remedy at law.

COUNTERCLAIM V: DECLARATORY JUDGMENT OF NON-INFRINGEMENT OF U.S. PAT. NO. 7,706,458

23. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

24. Based on American Patents' filing of this action and at least BRK's Second Defense, an actual controversy has arisen and now exists between the parties as to whether BRK infringes the Asserted Patents.

25. BRK has not and is not now infringing any claim of the '458 Patent under any

theory, including directly (whether individually or jointly) or indirectly (whether contributorily or by inducement).

26. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that BRK has not infringed and does not infringe any valid and enforceable claim of the ’458 Patent, whether directly, indirectly, individually, jointly, contributorily, and/or by inducement. BRK does not have an adequate remedy at law.

COUNTERCLAIM VI: DECLARATORY JUDGMENT OF INVALIDITY OF U.S. PAT. NO. 7,706,458

27. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

28. Based on American Patents’ filing of this action and at least BRK’s Third Defense, an actual controversy has arisen and now exists between the parties as to the validity of the claims of the Asserted Patents.

29. The claims of the ’458 Patent are invalid because the alleged inventions fail to satisfy the conditions for patentability specified in 35 U.S.C. § 100 et seq., including §§ 101, 102, 103, and/or 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto.

30. Pursuant to the Federal Declaratory Judgment Act, 28 U.S.C. § 2201 et seq., and Title 35 of the United States Code, BRK requests a declaration by the Court that the claims of ’458 Patent are invalid for failing to satisfy the conditions for patentability specified in 35 U.S.C. § 101 et seq., including, without limitation, §§ 101, 102, 103, and/or 112, the non-statutory doctrine of double patenting, and the rules, regulations, and laws pertaining thereto. BRK does not have an adequate remedy at law.

COUNTERCLAIM VII: DECLARATORY JUDGMENT OF NON-INFRINGEMENT OF U.S. PAT. NO. 6,847,803

31. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

32. Based on American Patents' filing of this action and at least BRK's Second Defense, an actual controversy has arisen and now exists between the parties as to whether BRK infringes the Asserted Patents.

33. BRK has not and is not now infringing any claim of the '803 Patent under any theory, including directly (whether individually or jointly) or indirectly (whether contributorily or by inducement).

34. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that BRK has not infringed and does not infringe any valid and enforceable claim of the '803 Patent, whether directly, indirectly, individually, jointly, contributorily, and/or by inducement. BRK does not have an adequate remedy at law.

COUNTERCLAIM VIII: DECLARATORY JUDGMENT OF INVALIDITY OF U.S. PAT. NO. 6,847,803

35. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

36. Based on American Patents' filing of this action and at least BRK's Third Defense, an actual controversy has arisen and now exists between the parties as to the validity of the claims of the Asserted Patents.

37. The claims of the '803 Patent are invalid because the alleged inventions fail to satisfy the conditions for patentability specified in 35 U.S.C. § 100 et seq., including §§ 101, 102, 103, and/or 112.

38. Pursuant to the Federal Declaratory Judgment Act, 28 U.S.C. § 2201 et seq., and

Title 35 of the United States Code, BRK requests a declaration by the Court that the claims of '803 patent are invalid for failing to satisfy the conditions for patentability specified in 35 U.S.C. § 101 et seq., including, without limitation, §§ 101, 102, 103, and/or 112. BRK does not have an adequate remedy at law.

COUNTERCLAIM IX: DECLARATORY JUDGMENT OF UNENFORCEABILITY OF U.S. PATENT NO. 7,706,458

39. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, as if fully set forth herein.

40. Based on American Patents' filing of this action and at least BRK's Ninth and Tenth Defenses, an actual controversy has arisen and now exists between the parties as to the enforceability of the claims of the Asserted Patents.

41. American Patents and/or American Patents' predecessors-in-interest with respect to one or more of the Asserted Patents have engaged in standards-setting misconduct, including, without limitation, breach of the commitment to disclose standard-essential patents.

42. As set forth in BRK's Defenses, Dr. Apurva Mody is a named inventor of the '782, '304, and '458 patents. American Patents alleges that BRK has infringed the '782, '304, and '458 patents because the accused products support IEEE 802.11n/ac standards. Dr. Mody is listed as a member of the individual balloting committee that voted on the IEEE 802.11n standard. His participation in the standard-setting process for IEEE 802.11n and 802.11ac came with an obligation to disclose any standards-essential patents. Based on Plaintiff's allegations in this matter, the '782, '304, and '458 patents are essential to the IEEE 802.11n/ac standards. On information and belief, Mody failed to disclose the '782, '304, and '458 patents prior to the voting, approval, and/or publication dates of IEEE 802.11 n/ac. This constitutes standard-setting misconduct, threatening continued harm to defendants and relevant third parties, rendering at

least the ’782, ’304, and ’458 patents unenforceable.

43. Further, on information and belief, the ’782 patent, the ’304 patent, and the ’458 patent were previously assigned to BAE Systems, a member of the European Telecommunications Standards Institute (“ETSI”). Based on Plaintiff’s allegations in other matters (e.g., *American Patents LLC v. Coolpad Group Limited* et al, No. 4:19-CV-877 (E.D. Tex.)), the ’782, ’304, and ’458 patents are essential to the LTE standards (e.g., ETSI TS 136 331). To the extent that BAE Systems failed to disclose those patents as required by ETSI’s Intellectual Property Rights policy, such violations render at least the ’782, ’304, and ’458 patents unenforceable. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that the claims of the ’458 patent are unenforceable. BRK does not have an adequate remedy at law.

COUNTERCLAIM X: DECLARATORY JUDGMENT OF UNENFORCEABILITY OF U.S. PATENT NO. 7,310,304

44. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, including paragraphs 41-43, as if fully set forth herein.

45. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that the claims of the ’304 patent are unenforceable. BRK does not have an adequate remedy at law.

COUNTERCLAIM XI: DECLARATORY JUDGMENT OF UNENFORCEABILITY OF U.S. PATENT NO. 7,088,782

46. BRK restates and incorporates by reference the entirety of the foregoing paragraphs, including paragraphs 41-43 as if fully set forth herein.

47. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that the claims of the ’782 patent are unenforceable. BRK does not have an adequate remedy at law.

COUNTERCLAIM XII: DECLARATORY JUDGMENT OF UNENFORCEABILITY OF U.S. PATENT NO. 6,847,803

48. Based on American Patents' filing of this action and at least BRK's Ninth and Tenth Defenses, an actual controversy has arisen and now exists between the parties as to the enforceability of the claims of the Asserted Patents.

49. American Patents and/or American Patents' predecessors-in-interest with respect to one or more of the Asserted Patents have engaged in standards-setting misconduct, including, without limitation, breach of the commitment to disclose standard-essential patents.

50. Nokia, the predecessor-in-interest to the '803 Patent, identified numerous Patents as essential to the 802.11 standard, including in relation to the 802.11ac standard, and beamforming technologies which are allegedly a contribution of the '803 Patent adopted by the 802.11ac standard. For example, Nokia made standards commitments for U.S. Patent Nos. 7,440,760, 8,422,961, and 6,298,035. On information and belief, if the '803 patent was a standards-essential patent as American Patents appears to allege, American Patents' predecessor-in-interest should have also made a standard commitment for the '803 patent. On information and belief, Nokia representatives participated in the drafting and approval of the 802.11ac standard but failed to disclose the '803 patent. This constitutes standard-setting misconduct, threatening continued harm to BRK and relevant third parties, rendering the '803 patent unenforceable.

51. Pursuant to the Federal Declaratory Judgement Act, 28 U.S.C. §2201 et seq., BRK requests a declaration by the Court that the claims of the '803 patent are unenforceable. BRK does not have an adequate remedy at law.

EXCEPTIONAL CASE

52. For the reasons set forth in BRK's Additional Defenses and Counterclaims, this is

an exceptional case entitling BRK to an award of attorney fees pursuant to 35 U.S.C. § 285.

DEMAND FOR JURY TRIAL

BRK hereby demands a trial by jury on all issues so triable raised by American Patents' Complaint or by BRK's Answer and Counterclaims.

PRAYER FOR RELIEF

WHEREFORE, BRK respectfully requests that this Court enter judgment in BRK's favor against American Patents and issue an order that includes:

A. A declaration that BRK has not infringed, and does not infringe, either directly, indirectly, or otherwise, any valid and enforceable claim of the Asserted Patents;

B. A declaration that the claims of the Asserted Patents are invalid and unenforceable;

C. A declaration that Plaintiff take nothing by its Complaint;

D. Judgment against American Patents and in favor of BRK;

E. Denial of Plaintiff's request for injunctive relief;

F. Dismissal of the Complaint with prejudice;

G. A finding that this case is an exceptional case under 35 U.S.C. § 285 and an award to BRK of its costs and attorneys' fees incurred in this action; and

H. Further relief as the Court may deem just and proper.

Dated: September 3, 2021

Respectfully submitted,

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Counsel for Defendant BRK Brands, Inc.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that, on this 3rd day of September 2021, the foregoing document was electronically filed via the Court's ECF system, which served a copy thereof on all counsel of record for who are deemed to have consented to electronic service.

Michael C. Smith